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Understanding the messy realities of teaching with technology in secondary school physical education in Scotland - An examination of the habits and practices of lead users

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Declaration

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I declare that this thesis has been composed solely by myself and that it has not been submitted, in whole or in part, in any previous application for a degree. Except where states otherwise by reference or acknowledgment, the work presented is entirely my own.

Murray Craig Date: 30th December 2018

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Abstract

There is lack of research focused on the '…'messy' realities of educational technology use *in situ'* (Selwyn 2014 p.161). Following Selwyn's recommendations for tracing a 'bigger picture', this study aimed to examine Physical Education (PE) teachers' technology related habits on multiple levels, namely a macro level analysis of the wider socio-political backdrop, together with the national and local contexts influencing their associated practices with technology.

Nine secondary school PE teachers in Scotland, all of whom were recognised by colleagues as being proficient in the use of technology, took part in the study. Two semi-structured interviews were conducted with each participant at their respective schools, in order to explore their experiences using technology, as well as their associated wider habits and practices with it.

Close analysis of the data revealed the overarching concept of 'weighted investment' by the participants, which encapsulates their wider involvements associated with technology. The concept depicts the manner in which the teachers engaged with technology, specifically the time and effort they devoted to it and an appreciation of why they seemed predisposed to engage with technology. Specifically, the main reasons for investing time and energy, and undertaking practices with technology, relate to career advancement, enhancing pupil engagement, personally-held values and beliefs about technology use, and increasing professional expectations. However, the lack of a strategic overview for technology at local and national level, limited infrastructure and inconsistent technical support compounded matters with respect to the time and effort they were having to invest.

These insights contribute to the education and physical education literature by presenting a more comprehensive picture of PE teachers' use of technology in comparison to past studies.

Chapter 1 Introduction

1.1 Overview

The purpose of this opening chapter is to establish and present the wider purposes of the study. The chapter has been divided into four parts. The first section deals with identifying and confirming two specific knowledge gaps in the literature relating to technology and schooling, namely inattention to wider matters concerning teachers use of technology, as well as under theorization of the field. The subsequent section considers the context for the study highlighting in more explicit terms why the use of technology in the current Scottish education system warrants further investigation. The discussion then proceeds to examine the use of technology within physical education (PE), and presents a rationale for why further research is required in this particular subject area. The fourth and final section of the chapter defines what I mean when I refer to technology - determining the parameters of the term within the context of my research.

1.2 Identifying the knowledge gap(s)

1.2.1 Neglecting the 'bigger picture'

This study seeks to address a knowledge gap repeatedly recognised by Selwyn (2011, 2014 and 2017), namely a lack of research focused on the *'...'messy' realities of educational technology use* in situ*'* (Selwyn, 2014 p.161). Selwyn suggests researchers need to develop greater awareness of the *'bigger picture'* (Selwyn, 2017 p.vi) as regards technology use in schools. Furthermore, he advocates a broad investigative stance on such matters in order to address the gap (Selwyn, 2017). Such a perspective might involve examining teachers' associated practices with technology on multiple levels. For example, a macro level analysis of the wider socio-economic and political

backdrop, as well as a meso and micro level examination of national and more immediate local contexts in which teachers practice, and how they have influenced their habits and practices with technology. However, Selwyn (2011) maintains that such an approach is frequently overlooked. Instead, he observes that researchers have favoured narrowly designed studies focused on technology use at a micro level:

> For every rich ethnographic study of classroom struggles over technology, there are literally thousands of anodyne, a-critical…pieces of 'research' pertaining to 'prove' some impact or other that can be associated with digital technology.
>
> Selwyn (2011, p.151)

Whereas Selwyn's appeal is directed at all sectors and disciplines within the educational community, others are more specific and appeal directly to those involved in discrete subject areas. For example, Casey, Goodyear and Armour (2017), Gard (2014) and Lupton (2015) focus on future research agendas within PE. Firstly, Lupton (2015) claims: *'We know little as yet about how schools, teachers…are participating in, accepting or alternatively resisting the digitisation of HPE* [Health and Physical Education]*'* (p.129), and subsequently appeals for further accounts and social research in this area. However, Casey *et al.* (2017a), like Selwyn (2014), are more explicit in highlighting concerns with the methodologies employed in previous research. Casey and colleagues believe there is a need to relocate the debate from being about the use of particular items or tools (and their impact), and instead adopt a more general perspective on technology. One which they believe should consider *'the wider education milieu'* (p.254), in particular how the educational environment and setting influences teachers' habits and practices with technology (Casey *et al*. 2017a). Lastly, Gard (2014) suggests the debate should be extended further to consider wider issues

concerning technology and the impact those issues may have on teachers' practices, specifically: *'...the new connections and power relationships it* [technology] *will facilitate...'* (p.840).

Before proceeding it is worth acknowledging that Casey *et al.* (2017a), Gard (2014) and Lupton's (2015) calls are not entirely new. Indeed, Tearle and Katene (2005) made a similar appeal over a decade ago. The author's maintained that the limited body of research published up until that point was useful in exemplifying how and why specific technologies might be employed within PE. However, they also criticized the context and narrow focus of said research, claiming it often overlooked wider issues and aspects relating to PE teachers use of technology. Evidence presented later in the chapter (see 1.4) indicates that Tearle and Katene's (2005) initial call for future research in PE to broaden its focus to consider more contextual matters has gone unheeded, and that Casey *et al.* (2017a), Gard (2014) and Lupton's (2015) renewed appeals are both timely and warranted.

1.2.2 Under-theorizing

Following on from the initial purpose of my study, a further aim was established to address the under-theorisation of technology use in education (Costa, Hammond and Younie, 2017; Mishra and Koehler, 2006; Oliver, 2013). Selfe (1990) appealed for more theory driven research in this area over a quarter of a century ago:

> Until we examine the impact of computer technology . . . from a theoretical perspective, we will continue, myopically and unsystematically, to define the isolated pieces of the puzzle in our separate classrooms and discrete research studies. Until we share some theoretical vision of this topic, we will never

> glimpse the larger picture that could give our everyday classroom efforts direction and meaning.
>
> (Selfe, 1990, p.119)

However, similar, more recent calls by Oliver (2013) and Costa *et al.* (2017) suggest that there has been limited advancement in terms of theorizing the field in the intervening years. Indeed, Oliver's (2013) concern that the last decade in particular has seen a proliferation of oversimplified and uncritical research is arguably confirmed by evidence presented later (see 1.4). Moreover, Oliver's (2013) response is an appeal for more developed, abstract accounts of technology use in education in order to gain fresh perspectives which shift from a default position of understanding what technology is and how it is used, to instead undertaking *'...practical or emancipatory critiques of technology'* (p.33). However, as Mishra and Koehler (2006) acknowledge, theory development in this area is challenging given the complex, contextually bound relationships involved. Issroff and Scanlon (2002) share this view, highlighting in more explicit terms some of those multiple, interconnected factors that need to be accounted for when theorising teachers' practices with technology: *'...the context of the institution, the culture of the students, the location of the learning situation within the curriculum as well as the design of the technology and software'* (p.10). Furthermore, Issroff and Scanlon (2002) maintain that in order to achieve this, a multi-level approach is required. This is compatible with the broad investigative stance advocated by Casey *et al.* (2017a), Gard (2014), Lupton (2015), Tearle and Katene (2005), and Selwyn (2017) highlighted in the previous section. Having now established, in more general terms, potential knowledge gaps in the research, the next section will begin to confirm those gaps, as well as consider the setting for the present study.

1.3 The Scottish context

The Scottish Government has a history of being proactive in supporting technology use in schools. Recent policies and initiatives include: the development of 'A national digital learning and teaching strategy for Scotland' (Scottish Government, 2016); launching GLOW - the first national online platform for learning (Education Scotland, 2015); improving internet connectivity in schools via the Scottish Wide Area Network (SWAN) (Education Scotland, 2015); as well as developing a national procurement framework for schools and local authorities allowing significant savings on the purchase of devices and hardware (Scottish Government, 2018a).

Given previous and current policies and programmes to support the use of technology for learning and teaching in Scotland, it is unsurprising that technology use features prominently within the current national curriculum for 3-18 year olds - Curriculum for Excellence (CfE). Support materials for CfE advocate the use of technologies, maintaining, in more general terms, that they have an important role to play in developing the knowledge, skills and qualities in pupils that will allow them to meet the challenges of contemporary society (Scottish Government, 2009a). More explicit evidence is found within the four capacities (Confident Individuals, Effective Contributors, Responsible Citizens, Successful Learners), which lie at the heart of CfE. For example, the policy maintains that in order to be considered a 'Successful Learner', pupils should be able to demonstrate their ability to *'use technology for learning'* (Scottish Government, 2009a p.iii). Alongside educational policy the use of technology is promoted in the professional teaching standards determined by the General Teaching Council for Scotland (GTCS)[1]. For example, in order to achieve full

[1] GTCS - This is an independent body established to maintain a register of qualified teachers in Scotland, set professional standards for teaching, accredit ITE programs, advise Scottish Government

registration, teachers in Scotland must possess and demonstrate: *'...secure knowledge and understanding of current guidance on the use of digital technologies in schools and know how to use digital technologies competently to enhance teaching and learning'* (GTCS, 2012a p.9); as well as: *'skilfully deploy a wide variety of innovative resources and teaching approaches, including digital technologies…'* (GTCS, 2012a p.14). However, it should be noted that such requirement for knowledge and skills in relation to technology is not unique to Scotland, and is increasingly present within mandatory teaching standards in other countries (Pyle and Esslinger, 2014; Sinelnikov, 2012).

Despite the positioning of technology within centrally prescribed policies and professional teaching standards, as well as recurrent Government led initiatives, findings indicate it remains peripheral to the learning and teaching taking place in Scottish schools. A recent report by Education Scotland, based on 40 exploratory visits across the early years, primary and secondary sectors, concluded that *'the extent of change in technologies…in recent years has been, at best, modest in too many centres and schools'* (Education Scotland, 2014 p.42). Furthermore, despite the widespread promotion and support, technology is not prominent within lessons: *'it is often the case that ICT is indeed used as an 'enhancement' to learning; activities, however supportive, which are on the fringes of the main purpose or task of a lesson'* (Education Scotland, 2014 p.36). These findings correspond with results from the 'Impact of ICT Initiatives in Scottish Schools (IIISS)' study carried out a decade before (Condie, Munro, Muir and Collins, 2005). The IIISS was undertaken from 1999-2005 to determine the impact of various technology related initiatives, such as the National

on matters relating to teacher professionalism (See GTCS website – Statutory Functions for further information http://www.gtcs.org.uk/about-gtcs/statutory-functions.aspx)

Grid for Learning (NGfL) and the New Opportunities Fund (NOF), that were promoted and supported by the then Scottish Executive. Like Education Scotland's (2014) more recent findings Condie *et al.* (2005) reported:

> There is evidence of a move towards integrating ICT into the everyday experiences of pupils through purposeful tasks and the effective use of different aspects of technology to support learning. The extent to which this has happened is limited as yet, both within and across schools.
>
> (Condie *et al*. 2005 p.75)

The findings reveal little progress has been made in the intervening years despite continued support from the Scottish Government and other associated parties. Before proceeding to consider why progress has been limited it is worth noting that findings reported here are not unique to Scotland. A recent report by the Organisation for Economic Co-operation and Development (OECD) provides an international comparative analysis of the technological competencies of pupils, as well as how technology has been integrated into the learning and teaching environments in schools across 64 countries. Results from the OECD (2015a) survey indicate the issues reported in Scotland are more widespread. Similar to Education Scotland (2014) and Condie's *et al.* (2005) findings the OECD reported that: *'despite the pervasiveness of information and communication technologies (ICT) in our daily lives, these technologies have not yet been as widely adopted in formal education'* (OECD, 2015a p.15). Furthermore, the report concludes that *'the impact of technology on education delivery remains sub-optimal'* (p.4).

Turning attention back to Scotland, despite repeated initiatives and continued support for technology use in schools the level of academic interest in this area has, like the impact of those initiatives, been modest. It is apparent from the following overview

the body of research that exists is varied. Furthermore, upon closer examination the concerns raised earlier in this chapter with regards to research in this area are evident, namely narrowly designed studies focused on the impact of discrete devices or applications on specific aspects of learning and teaching. For example, the impact of: online learning platforms (Condie and Livingston, 2007; Elliot, Wilson and Boyle, 2014; Livingston and Condie, 2006) on science, mathematics and computing studies respectively; games consoles on Primary pupils' mental computation skills (Miller and Robertson, 2011); multimedia CD-Roms on research and critical thinking skills in history lessons (Hillis and Munro, 2005). Though, the narrow focus of the research carried out over this period is perhaps unsurprising given the recommendations in Condie's *et al.* (2005) impact report. The author's acknowledged that at the time pockets of innovative practice existed in schools, and highlighted the need to disseminate this good practice. Furthermore Condie and colleagues called for: *'more focused research on such innovations with the aim of providing support for other teachers…'* (Condie *et al.* 2005 p.75). A few studies carried out during this period did adopt more general perspectives and examine broader issues concerning the use of technology in Scottish schools, though those investigations still focused on specific devices and platforms as a conduit for considering those issues. For example, Beauchamp, Burden and Abbinett (2015) and Wilson and McKinney (2010) both considered matters to do with innovation and professional development using iPads and GLOW respectively. Conlon's (2008) critical examination of GLOW raised awareness of some of the unintended outcomes associated with the initiative in an attempt to redress what he termed the *'lack of balance in the discourse'* (p.64), on such matters. Nevertheless, it is apparent the emphasis placed on the use of technology in

Scottish schools is not reflected in both the volume and type of research carried out to date. The need for further investigation across all subject areas and sectors is apparent. In making a case for PE, it appears the subject currently commands a strong position within the curriculum in Scotland. More specifically, PE is located within the area of Health and Wellbeing (HWB), which along with literacy and numeracy are three core areas that are the responsibility of all practitioners in Scotland regardless of their subject specialism (Horrell, Sproule and Gray, 2011). At present it is the only subject area in the curriculum with a time stipulation, with the Scottish Government stating that every pupil will partake in at least two hours per week of PE in primary school, and two periods from S1 to S4 in secondary school (Scottish Government, 2018b). Given the current arrangements, and the positive implications they may have for the subject in terms of its status and perceived value (Gray, Mulholland and MacLean, 2012, Gray, MacLean and Mulholland, 2012), research focused on Scottish PE is both timely and warranted. Furthermore, it is contended here that research into technology use within the learning and teaching of PE in Scotland is particularly germane.

At the outset of this section it was highlighted that technology featured prominently within the more general CfE policy documentation. However, restatement and unambiguous support for the employment of technology is also found in subject specific policy. In particular, the learning and teaching approaches specific to Health & Well-Being (HWB), which advocate effectual delivery: *'...uses a variety of approaches including active, cooperative and peer learning and effective use of technology'* (Scottish Government, 2009b p.5). Moreover, the use of technology is not restricted to the broad general education phases delivered in the primary and early secondary years: support materials for the revised suite of certificated courses in PE

(SQA, 2012 a,b,&c) also promote its use: *'ICT can play an important role in the learning and teaching approaches in the new National Courses by supporting integration and learner personalisation and choice'* (SQA, 2012a, p. 6).

Following on from this, a central tenet of CfE is the notion of providing pupils, who are centrally positioned within the learning process of the new curriculum, with active and authentic learning experiences (Scottish Government, 2009b). Selwyn (2011) believes that technology based learning should also situate the learner at the heart of the teaching and learning process. Although not acknowledged within CfE policy documentation, the association between digital technologies and constructivist teaching and learning approaches is increasingly recognised (Conlon and Simpson, 2003; Herrington, Herrington, Mantei, Olney and Ferry, 2009; Papastergiou, 2011). Thus, the use of technology may have a significant role to play in the successful implementation of CfE.

Having now established a context for the present study, as well as beginning to confirm the knowledge gaps highlighted at the outset of the chapter (1.2), the following sections will refocus on matters pertaining to PE and why the subject area warrants further examination.

1.4 Physical education and technology

1.4.1 A rationale for a PE focus

Over the last decade there has been an increasing interest in the use of digital technologies in PE (Hilvoorde and Koekoek, 2017; Koekoek, van der Mars, van der Kamp, Walinga and Hilvoorde, 2018), coupled with an ever increasing encouragement for teachers to involve it in their day to day practice (Centeio, 2017). The perception is technology is becoming ever more important to teaching and learning in PE (Gotkas,

2012; Semiz and Levent Ince, 2012). Such a perception is supported by a proliferation of subject specific literature focused on the integration of technology. For example, many PE related texts, aimed at both pre-service and in-service teachers published in the last 10 years include sections or chapters on the use of technology within the subject (see Barret, 2014; Blair, 2006; Clarke, 2008; Lund and Tannehill, 2014; Tannehill, van der Mars and MacPhail, 2013; Miller, 2015; Parton and Light, 2010; Stidder and Capel, 2010; Morton, 2017; Taylor, 2009). In addition, there have been stand-alone publications dedicated to this particular area of practice and research within PE (see Casey, Goodyear and Armour, 2017; Hilvoorde and Koekoek, 2018). Furthermore, evidence presented in the subsequent section (1.4.2) indicates that empirical studies in this area are on the rise. Nevertheless, despite growing interest and encouragement for technology use, PE teachers' knowledge, skills, and practices with it remain limited (Cengiz, 2015; Kretschmann, 2012; Thomas and Stratton, 2006). Reasons why this might be the case - related to matters concerning time, professional development as well as resourcing, will be discussed in Chapter 2.

Despite initial hesitancy from the PE profession, it is acknowledged that involving technology may be important in terms of ensuring the status of the subject, as well as maintaining its relevance within the school curriculum (Gubacs-Collins and Juniu, 2009; Kretschmann, 2015b; Papastergiou, 2011; Shewmake, Merrie and Calleja, 2015). Indeed, its significance is emphasised by Casey *et al*. (2017a) when they point out that technology is *'...contemporary, socially relevant, politically important and culturally accepted...'* (p.249). These ideas are further supported by McNeil, Mukherjee, and Singh (2010), but, they go onto highlight the process of involving technology might not necessarily be a straightforward one: *'PE has to grapple with*

such technological advances to maintain its relevance…' (McNeil *et al*. 2010 p.16). However, it is contended that continued reluctance is no longer an option for PE practitioners. Technology, as Gard (2014), points out is now ever-present and consequently more difficult for teachers to reject, particularly given some of the claims made for what can be achieved by involving it in one's practice. Additionally, there may be increased pressure from pupils' who expect the technologies they rely on in their everyday lives be incorporated into their lessons (Kretschmann, 2015b). Matters concerning relevance and PE are also considered by Gard, Hickey-Moodey and Enright (2013), although not specifically in relation to the use of technology. Nevertheless, some of the ideas discussed are arguably relevant. In particular, teachers considering involving technology in their practice, need to be familiar with, and be able to draw distinctions between *'what they* [their pupils] *do'* with it, and *'what they* [their pupils] *value'* (p.102), about it. Understanding these ideas will allow them to take advantage of how best to employ technologies in order to make the teaching and learning in their lessons more relevant (Gard *et al*. 2013).

Finally, recent advancements in mobile technologies, in particular the development of tablet PC's and smartphones, coupled with decreasing costs, mean that devices and applications which better fit the requirements of the subject, and departmental budgets, are now more available (Clarke, 2008; Taylor, 2009; O'Loughlin, Ni Chroinin and O'Grady 2013; Tearle and Golder, 2008; Trout, 2013). These newer technologies, which are more adaptable to the various settings encountered in PE, have removed some of the constraints that hindered previous technologies (Gubacs-Collins and Juniu, 2009). The manner in which mobile technologies have been embraced and employed by the PE profession is perhaps unsurprising - as Taylor (2009) points out,

PE has regularly employed simpler forms of handheld technology, namely stopwatches and whistles!

Chambers, Sherry, Murphy, O'Brien and Breslin (2017) describe the advent of mobile tablet PC's as signalling a *'technological transition'* (p.55) in the practice of a PE teacher in their case study. Transition usefully describes the gradual shift that has occurred with regards to technology use in PE over the last decade, and given the profession is in the midst of this makes further research both timely and warranted.

1.4.2 Confirming the gap

Research carried out over the last decade has been useful in establishing the means by which technology can be used to enhance teachers' practices, as well as student learning in PE. However, upon closer examination, concerns raised by Tearle and Golder (2005), Casey *et al.* (2017a) and others at the outset of this chapter (see 1.2), are all too apparent. More specifically, an emphasis on investigating the impact of discrete devices, utilities and platforms upon a limited range of variables associated with learning and teaching. For example, the effect of: heart rate monitors and pedometers on pupils' physical activity levels (Clapham, Sullivan and Ciccomascolo, 2015); X-Box Kinect gaming on pupils' effort and enjoyment levels (Shewmake *et al.* 2015); digital video (DV) on pupil feedback and assessment (Palao, Hastie, Cruz and Ortega, 2015; Weir and Connor, 2009), DV on pupil motivation levels and capacity to self-assess (O'Loughlin *et al.* 2013), DV on pupils' planning, performing and evaluating skills (Brooker and Daley-James, 2013), DV on pupil engagement (Casey and Jones, 2011); wikis on co-operative practices (Hastie, Casey and Tarter, 2010); video review technology on pupil motivation (Legrain, Gillet, Gernigon and Lafreniere, 2015). Furthermore, as Kretschmann (2015a and b) acknowledges much

of the PE research to date has focussed on the impact of technology on the pupils, as opposed to investigating its use from teachers' perspectives. Researchers did not neglect teachers entirely during this period, but studies that did consider matters from teachers' perspectives reveal similar concerns to the pupil focused research. Once more, the majority of studies focus on a narrow set of variables, namely discrete technologies and what they purport to do. For example, the impact of: a website design course on knowledge, skills and confidence using technology (Papastergiou, 2011); website development on Technological Pedagogical Content Knowledge (TPCK), Technology Integrated Self-Efficacy (TISE) and Instructional Technology Outcome Expectations (ITOE) (Cengiz, 2015); age, gender, frequency of computer use and ownership on teachers' attitudes towards the use of technology for learning and teaching (Gotkas, 2012); blogging on the acquisition of knowledge of practical skills, as well as efficacy levels using technology (Papastergiou, Gerodimos and Antoniou, 2011); and podcasting on social, emotional and pedagogical learning in PE (McNeill *et al.* 2010). In addition, it was apparent many of those studies recruited participants from pre-service education, with very few involving in-service PE practitioners.

While this brief overview highlights potential shortcomings in previous research it is important to acknowledge that it has been instrumental in developing my initial understanding of what, how and why technology might be used in PE, highlighting practices, as well as identifying potential benefits to be gained from the implementation of specific tools and devices (Tearle and Katene, 2005). Though, my views align with Mishra and Koehler (2006) who frame this research as an initial building block upon which more sophisticated theoretical understandings of the field should be developed.

Having established why PE warrants further investigation, as well as confirming in more explicit terms the knowledge gap highlighted at the outset of the chapter, the next section attempts to operationalize the term *technology*, emphasizing what is being referred to when the term is used in the present study.

1.5 Defining technology

Mackenzie and Wajcman (1985) acknowledge: *'The term* [technology] *is a slippery one'* (p.3). Lievrouw and Livingstone (2006) elaborate on this, suggesting that given the multiple ways in which the term is used within both practice and research, agreement on a precise definition has proved challenging and elusive. Therefore, before proceeding it is important to establish the parameters of the term within the context of my research. Given the nature and intended purpose of the present study, namely the adoption of a broader investigative stance, a simple definition will not suffice.

Rather than drawing on one particular characterization of technology, an amalgam of Arthur (2009), Lievrouw and Livingstone (2006) and Mackenzie and Wacjman's (1985) definitions of what 'technology' represents will be used (see fig. 1). Given the conceptual and structural similarities between those definitions, or frameworks, it seems achievable to integrate them for my purposes here. Furthermore, given that each definition is wide-ranging, a summation of their different ideas allows me to define 'technology' in even broader terms.

Firstly, a central tenet of Arthur (2009), Lievrouw and Livingstone (2006) and Mackenzie and Wacjman's (1985) definitions is that the term is multilateral, with each author conceptualizing technology on three increasingly abstract levels (see fig. 1).

The notion that technology, as a concept, is multidimensional is accepted in the present study, and underpins the notion that what the term represents is wide-ranging.

	Mackenzie and Wacjman (1985)	Lievrouw and Livingstone (2002)	Arthur (2009)	
1st Level	Physical objects	Artefacts and devices	Devices and processes	1st Level
2nd Level	Human activities with technology	Practices engaged in with the devices	A body of artefacts or practices	2nd Level
3rd Level	Knowledge on how to use technology	Social arrangements and customs formed around the artefacts and practices	Totality of those practices and devices	3rd Level

Figure 1: Definitions of technology

Secondly, drawing once more on each of the three definitions it will be assumed that the term technology not only refers to discrete material[2] and non-material[3] artefacts, but also the activities and practices undertaken with those objects. Mackenzie and Wacjman's (1985) suggestion that the term represents not only what is done with technology, but also the 'know-how' or knowledge that allows it to be used in particular ways is also acknowledged. Furthermore, Lievrouw and Livingstone's (2006) view that the term concerns the context in which technologies are used, more specifically the social arrangements and order that arise around the technology and the use of it is also accepted. Lastly, Arthur's (2009) view that technology be regarded not only in an individual sense, as discrete devices or processes, but also in more collective terms - for example bodies of technology, such as biotechnologies, information and communication technologies - and in its totality is important to my analysis.

Finally, it is understood that all three definitions have their strengths and limitations, and adopting only one of them for the present study might be acceptable. However, Lievrouw and Livingstone's (2006) claim that: *'The field* [educational technology]

[2] Material artefact - This could be particular device such as a tablet PC or a wearable activity tracker.
[3] Non-material artefact - This could be a specific platform or application such as 'twitter'

needs a definition that is abstract enough to accommodate the range of systems, contents, issues and settings that researchers consider essential' (p.21), supports the decision to integrate the three given the intended scope of the investigation. Thus, for my study, technology will refer to the physical hardware and software used on devices, as well as the associated knowledge and specific habits and practices carried out with technology. Additionally, the term will be used in a collective sense referring to technology as a whole, namely as a body of practices and devices.

1.6 Summary

The aim of this opening chapter was to establish the wider purposes of the study. In order to do so a brief summary of research literature relating to technology use in schools and schooling was provided. Furthermore, the chapter emphasised a need for further research in this area within the current Scottish context, in particular within the subject area of PE. Consequently, the following aims were developed:

- To adopt a broader investigative stance in attempting to understand the 'messy realities' of technology use in Scottish secondary schools, focusing on the day to day practices of lead users in PE.
- To employ a multi-level approach, focussing on micro, meso and macro matters, in order to develop a more sophisticated understanding of those lead users' routine behaviours and practices with technology in Secondary school PE in Scotland.
- To theorize Secondary school PE teachers in Scotland's everyday habits and practices with technology, with a particular focus on lead users.

Chapter 2 Review of literature

2.1 Overview

To this point the focus has been on identifying and confirming a knowledge gap in the literature, as well as highlighting in more explicit terms why PE teachers in Scotland's use of technology warrants further investigation. The aim of this chapter is to determine the more specific purposes of my study. The early discussion will examine teachers' motivations for using technology, with an appreciation that their reasons, whether implicit or explicit, influence their habits and practices with it. Following this, current practices with technology in schools will be considered along with an overview of reported barriers to its use. Throughout the chapter the discussion will draw on general findings, as well as those in the PE literature. Furthermore, in keeping with the wider ambitions of the study outlined previously, the latter sections will consider ideological matters affecting teachers use of technology. In particular, the system of ideas and ideals associated with technology and schooling, and the consequent impact these have on teachers' associated habits and practices will be examined.

2.2 Teachers' motivations for using technology

It is acknowledged teachers use of technology - for learning and teaching purposes, is largely dependent on their beliefs and attitudes towards it (Chen, 2008; Mumtaz, 2006). Motivations for incorporating technology into their everyday learning and teaching practices has received considerable attention in recent years (see Uluyol and Sahin, 2016; Yeung, Tay, Hui, Lin and Low, 2014; Karaseva, Pruulmann-Vengerfeldt and Siibak, 2017; Hobbs and Tuzel, 2017). Furthermore, research, albeit limited, has considered this area within PE, for example Bisgin (2014), Gotkas (2012), Kretschmann (2015a), Lockyer and Paterson (2007), and Thomas and Stratton (2006).

Those studies are valuable in highlighting positive inclinations of pre- and in-service PE teachers' towards the use of technology, however, they do not explain in more explicit terms how teachers' attitudes and motivations impact on their practice. Though, as discussed previously (see 1.4.1 and 1.4.2) the last 10 years has seen an increase in literature focussed on specific practices in PE using various technologies. Those studies have been invaluable in exemplifying possible practice, as well as providing guidance on how to use technology more purposefully within PE. However, the majority of studies do not elaborate on teachers' motivations for involving technology in their practice, and thus we are not fully aware of their reasons for using it (Casey *et al*. 2017a). Much of the previous research cites singular, or a limited number of reasons why technology was employed by either or both the teachers and researchers. Furthermore, the motives reported were often external, focused on a particular outcome or consequence concerning the learners, with teachers' personal reasons for using technology often overlooked. For example: Palao *et al.* (2015) examined the impact of video technology on both skill-execution and knowledge acquisition in secondary school students with respect to hurdling in athletics; whereas, Legrain *et al.* (2015) studied the effect of a technology intervention on the engagement of early secondary pupils in gymnastics. Nevertheless, the following discussion reveals teachers' beliefs and motivations, with respect to involving technology in their practice, are perhaps not as straightforward as those studies suggest.

Ottenbreit-Leftwich, Glazewski , Newby and Ertmer (2010) found that teachers' held a wide set of beliefs about technology. They reported multiple interconnected motives for using it in their practice, which included a range of professional purposes, as well as reasons related to the needs of their students. However, if findings presented in the

previous chapter are considered (see 1.3), it is conceivable teachers' have additional professional, as well as personal reasons for employing technology alongside those reported by Ottenbreit-Leftwich and colleagues. For example, in terms of professional reasons, it was highlighted that practitioners' knowledge and skills with technology are increasingly present within professional teaching standards (Pyle and Esslinger, 2014; Sinelnikov, 2012). Thus, the use of technology is perhaps no longer a choice for teachers, with an increasing expectation, and in some instances a requirement, that they will use it in their day to day practice (Barrett, 2014; Enright *et al.* 2017; Roth, 2012).

With regard to personal reasons Wolcott and Betts (1999) found that career advancement was a motivating factor for using technology in higher education (HE). The HE practitioners in their study believed that involvement in the development and delivery of online distance learning courses: *'afforded them certain career-enhancing prerequisites'* (p.39). More specifically, they believed it would enhance their reputation, as well as creating a niche for themselves within the sector (Wolcott and Betts, 1999). However, the author's acknowledged that career advancement was a *'side-benefit'* (p.39) associated with technology, as opposed to a primary motivating factor in its use. A similar perspective is expressed by the PE practitioner (Andy) in Fletcher, Vasily, Bullock, Kosnik and Ni Chronin's (2017) case study. In particular, he indicates that his use of technology, in this instance blogging, was motivated by an unsuccessful job application. Furthermore, he felt compelled to use the online platform as a medium to showcase the quality of his work, aware that he could draw on this for future applications.

In closing, findings presented in this section support a view that teachers' beliefs about technology may not be straightforward, and their reasons for employing it are varied. External factors may influence teachers practice, for example, professional teaching standards, as well as national and local educational policy. Such factors might compel teachers to use technology, as well as determine the manner in which they use it - often passively and not realising its full potential, yet still allow them to fulfil professional obligations, as well as benefit any longer term career ambitions they might have.

2.3 Current practices with technology

Although concerns with both the nature and scope of previous research in this area were raised in Chapter 1 (see 1.4), Tearle and Katene (2005) acknowledge the findings from the research have been somewhat useful. In the absence of any guidelines, some studies have been helpful in establishing more imaginative, learner-centred practices with particular technologies, as well as identifying potential learning and teaching benefits to be gained from their implementation within PE. Ottenbreit-Leftwich *et al.* (2010) highlight that best educational practices with technology are often characterised as being pupil-centred, and foster active learning in the form of problem solving, self-regulation and higher order thinking. However, it is claimed that technology use depicted in the research is not common practice amongst PE teachers (Kretschmann, 2015b). Evidence indicates technology is often used for administrative tasks to ease workflow, more specifically lesson preparation, as well as for monitoring, assessing, recording and reporting purposes (Gubacs-Collins and Juniu, 2009; Lavay, Sakai, Ortiz and Roth, 2015; Thomas and Stratton, 2006). Findings also reveal teachers have a tendency to use technology in a superficial manner, with it often peripheral to the learning that takes place in lessons. Moreover, teachers frequently do not adjust their

pedagogical practices in order to involve technology in their teaching. Rather they use it as an add-on that sustains more conventional delivery methods associated with rote learning, with little or no evidence of new innovative practice on their part (Culp, Honey and Mandinach, 2005; Cuban, 2001; Conlon and Simpson, 2003). Parton and Light (2010) observed such issues in PE, and claimed that technologies are often an adjunct to existing practices and curriculums in PE, without any thought for the re-definition or repositioning of it when used within lessons. Goepel (2012) suggests such practices, which appear to be commonplace, amount to nothing more than *'tick-box professionalism'* (p.502). Thus, it is not enough to have technology available and to use it in an auxiliary fashion: considerable forethought is required by teachers, along with relevant professional development and training, so as to effectively integrate technology into lessons and in order to realize its potential (Pritchett, Wohleb, and Pritchett, 2013; Wiske, 2004).

It is reported that technology not only increases productivity with respect to administrative tasks, but also improves efficiencies in aspects of teachers' delivery within lessons. In particular, Casey *et al.* (2017a) claim that technology is allowing for *'further, faster, stronger'* teaching and learning (p.255). Nevertheless, Casey and colleagues also note teachers' pedagogical practices and approaches often remain the same as before they involved technology. Thus, it seems despite supplementing their teaching, technology has not altered their pedagogical practices, and in some instances it has further entrenched previously established teaching habits. Although not transforming teachers' practices, the use of technology does appear to have enhanced the teaching and learning that takes place, though not in the manner, or to the extent, that advocates of educational technology might have hoped. For example, personalized

and collaborative features that are inherent to newer digital technology that has emerged in recent years arguably have the greatest potential to enhance or even transform aspects of education (Pritchett *et al*. 2013). However, it is maintained these features and the opportunities they afford teachers are rarely realized (Gubacs-Collins and Juniu, 2009; Parton & Light, 2010). It emerges the potential of technology is recognized and achieved infrequently. Tearle and Katene (2005), maintain effective use of technology, such as that described earlier by Ottenbreit-Leftwich *et al.* (2010), requires a marked change in teachers' pedagogical practices. However, they claim evidence of such teaching is limited to *'pockets of excellence'* (p.14), across the profession. Locating and investigating those pockets of expertise, and the teachers involved, would enable a more sophisticated understanding of how the potential of technology might be realized, and how the habits and practices of those teachers and departments could be used to inform and guide practice across the sector (Tearle and Golder, 2008). This is the approach I have taken in this research. Having now established teachers' motivations for using technology, as well as current practices with it, the discussion will proceed to examine some widely reported barriers that might prevent teachers from realizing the potential of it.

2.4 Barriers to technology use

Implementing technology in schools is recognised as a difficult and complex process - one which involves consideration of various technical, as well as socio-economic and political factors (Gotkas, 2012). Previous research reveals a range of seemingly interconnected barriers teachers face when involving technology in their practice (see Ertmer, 1999; Hew and Brush, 2007; Mumtaz, 2000). In terms of addressing those factors and barriers, several lines of evidence suggest senior managers and school

leaders who possess a clear vision for technology, and understand the connections between it and pupil learning are key to its effective implementation (Afshari, Bakar, Luan, Samah and Fooi, 2009; Hauge, Norenes and Vedøy, 2014; Hauge and Norenes, 2015; Tondeur, Devos, van Houtte, van Braak, and Valcke, 2009; OECD, 2015; Ottestad, 2013). Nevertheless, the focus of this section is identifying barriers to technology use in schools, as opposed to highlighting how they might be addressed. It is beyond the scope of this review to consider all of the barriers and issues highlighted in the literature, thus the discussion will focus on those most frequently reported by practitioners. That is issues pertaining to lack of time, meaningful professional development, as well as resources and technical support for technology (Kopcha, 2012; Prestridge, 2012; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur and Sendurur, 2012).

2.4.1 Time

It is helpful to consider lack of time under two sub-headings: lack of time to learn about technology, as well as lack of time to implement technology. Both are encapsulated in the comments by a teacher in Ertmer's *et al.* (2012) study: *'...I don't have the time to learn, and if I learn, I don't have time to do it'* (p.429).

Lack of time to learn

Firstly, with respect to lack of time to learn, acquiring the knowledge and skills to effectively implement technology into one's practice can be time consuming (OECD, 2015; Scottish Government, 2015a). However, findings indicate that limited time is allocated to teachers to allow them to learn and develop necessary knowledge and skills in this area of their practice (BECTA, 2007; Wilson and McKinney, 2012). It is

claimed practitioners are often self-taught, developing skills and expertise of their own accord and in their own time (Goodwyn, 2009; Tour, 2017; Wilson and McKinney, 2012). Furthermore, those teachers do not appear to acquire their knowledge and skills through traditional forms of professional learning and training. Instead, they describe spending considerable time playing and experimenting with technology (see Beauchamp, Burden and Abbinett, 2015).

Lack of time to implement

Evidence supports the notion that technology use can lead to time efficiencies in teachers' practices (BECTA, 2007; Cook, Levinson and Garside, 2010; Scottish Government, 2015a; Selwood and Pilkington, 2005). However, an initial investment of time and effort is required to become proficient at using the technology in order to release time within lessons at a later point (BECTA, 2007). Yet, with frequent concerns over teacher workloads (see DfE, 2017; Education Scotland, 2016), it is understood many practitioners may be unable to commit the time given other professional demands required of them. Although difficult to quantify the time that might be saved, as well as the initial outlay required, Harris's (2006) investigation of an online learning course provides some perspective. It was reported that time efficiencies were not realised until the second year of the program, with Harris reporting that a sizeable amount of time was required to develop, implement and manage the online content and materials throughout the first year of the course.

Lack of time to learn - PE

Findings from PE specific literature on barriers to technology use not only support conclusions drawn from the wider research, but also further our understanding about the concept of time - or lack of it. Time was the most frequently noted issue by PE

practitioners in both Tearle and Golder (2008) and Weir and Connor's (2009) studies. In Tearle and Golder's (2008) investigation teachers' responses were in line with Ertmer's *et al.* (2012) findings, namely little time for training, as well as limited time within lessons to use technology. A lack of time to learn featured prominently in other studies focused on PE (see BECTA, 2005; Thomas and Stratton, 2006). However, many PE practitioners appeared to be proactive in finding time - often in their own time out with school, to acquire the knowledge and skills that allowed them to involve technology in their teaching (BECTA, 2005; Jones, Schupbach, Harvey, Bulger, and Voelker, 2017; Parker, Morrison, Patton, Babkes, Hinchion and Hall, 2017). As a teacher in McCaughtry and Dillon's (2008) study of mobile technology use in PE put it: *'I learned so much more because I could take this* [PDA] *home and just play around with it. I wouldn't have gotten as good at it as I did without the freedom of taking it home'* (p.496). In line with Beauchamp's *et al.* (2015) findings, PE teachers learning is also characterised by extended periods of informal interaction, experimentation and playing with technologies (Casey, 2017a; Kretschmann, 2015b; Taylor, 2009; McCaughtry and Dillon, 2008; Palao *et al*. 2015; Parker *et al*. 2017). A sense of the of time invested in this process was apparent in McCaughtry and Dillon's (2008) study where teachers reportedly spent 6 months familiarising themselves with the technology. Though time consuming, such informal play was crucial, enabling the teachers to become familiar with the functions and utility of technology, as well as increasing their confidence in being able to implement it within their teaching.

Lack of time to implement - PE

Revisiting the issue of lack of time to implement technology, the PE literature provides insight into some unique constraints. An initial reason for teachers not implementing

technology within PE was over concerns it would limit the amount of physical activity occurring in lessons (Pyle and Esslinger, 2014) - a concern not only raised by teachers, but also pupils (Weir and Connor, 2009). This is a plausible reason given long running concerns about time allocated to PE within the school curriculum, and the need to optimize the time that is available (Dollman, Boshoff and Dodd, 2006; Hardman and Marshall, 2000). Similar issues were reported in relation to the time required to set up devices and applications before lessons (Tearle and Katene, 2005; Thomas and Stratton, 2006). A finding supported more recently by Weir and Connor (2009) and Palao *et al.* (2015). Teachers in both those studies raised concerns with being able to continue using technology in their lessons once the technical support provided by the research team was no longer available. It is claimed that setting up time does appear to lessen as teachers become more familiar with using technology and their practices with it become more routine (BECTA, 2005). Yet, as one PE teacher commented: *'Set-up time reduces with practice but doesn't go away altogether'* (BECTA, 2005, p.16). Finally, it is claimed that planning and preparing lessons that involve technology can also be more time consuming (Palao *et al*. 2015; Weir and Connor, 2009). A finding that corresponds somewhat with Pritchett *et al*. (2013) and Wiske's (2004) claims that considerable forethought is required by teachers in order to realize the potential of technology (see 2.3) - for example considering matters such as the role of technology within their lessons, and how this might impact on their role as the teacher, namely the pedagogical approaches they might use.

In addition to the time required to master the technology, plan for its use, as well as set it up, its involvement may add to teachers' workloads in other ways. For example,

in Hastie's *et al*. (2010) investigation into the use of Wikis[4] in PE, it was found that the platform led to increased interaction with students outside of lessons as the teacher reviewed and commented on their work. Although the technology had a positive impact on pupil engagement with the subject content, it had a detrimental effect on teacher workload. Thus, technology addressed one issue, but created another. Given recent concerns over increasing workloads within the profession (DfE, 2017; Education Scotland, 2016), it is conceivable that practitioners might be reluctant to use technology if they feel it compounds such matters.

2.4.2 Professional Development

Judge and O'Bannon (2007) maintain that ongoing professional development is a *'critical ingredient'* (p.289) for teachers wanting to employ technology effectively within their practice. However, Koehler and Mishra (2009) recognise the contexts in which teachers operate are both complex and diverse, and become even more so with the addition of technology. Yet professional learning in this area has not always accounted for the unique contexts and challenges faced by teachers. Furthermore, it is acknowledged that a one size-fits-all approach to teachers' professional development, such as generic courses or stand-alone workshops, are ineffectual in terms of purposefully integrating technology (Casey, Goodyear and Armour, 2017b; Franklin and Sessoms, 2005, Mishra and Koehler, 2009). Moreover, as Orlando (2014) highlights the likelihood is such professional learning is dismissed due to its irrelevance. Instead, it has been suggested that development and training opportunities should be tailored to the needs of teachers, in particular the specifics of their subject

[4] A wiki is a website where users work collaboratively to upload and modify content. See https://en.wikipedia.org/wiki/Wiki

areas, as well as the contexts in which they practice (Hew and Brush, 2007; OFSTED, 2011). Ottenbriech-Leftwich *et al.* (2010) support this notion of specificity, maintaining that such programs be aligned with teachers' beliefs, as well as their existing pedagogical approaches. Following on from this, Wilson and McKinney (2012) stress professional development should not solely focus on technology per se. Training should also develop knowledge and skills that allow teachers to make changes to their pedagogy in order to realize the potential of technology. Finally, Ertmer *et al.* (2012) recommend teachers adopt learning practices common in other professions, such as on the job training and collaborating with colleagues. They claim such practices would ensure teacher learning was context specific and more personalized to their needs. Furthermore, Ertmer *et al.* (2012) suggest that teachers make use of the same technologies they use in the classroom, for example social media platforms, wiki's and blogs, for their own learning in order to overcome issues and challenges associated with learning in the workplace. For example, teachers might use social media platforms, such as Twitter, to engage in professional dialogue, as well as to share practices with colleagues beyond their department and school.

Professional development - PE

Judge and O'Bannon's (2007) claim that professional development is a vital ingredient is a recurrent theme in the narratives of many of the PE practitioners in Casey's *et al.* (2017a) collection of pedagogical cases. For example, one teacher, Jarrod, believed professional learning was paramount when it came to successfully employing technology, suggesting that issues arise when teachers are given technology without any training, guidance or support. (Enright, Robinson, Hogan, Stylianou, Hay, Smith and Ball, 2017). Ertmer's *et al.* (2012) recommendation that practitioners use the same

technologies they would use in their teaching for their own professional learning was echoed in other cases. For example, Antonio and Joey described how they used the social media platform Twitter to interact, share and discuss practices with other like-minded practitioners (Calderon, Lopez-Chicheri, Fernandez-Rio and Sinelnikov, 2017; Gleddie, Feith, Howe, Larsson, Cale and Casey, 2017a). The professional learning undertaken by Antonio, Joey and others was seemingly self-initiated and directed. As a result their learning was personalised and specific to their particular needs and contexts in which they practiced. A finding in line with Hew and Brush (2007) Mishra and Koehler (2006) and Koehler and Mishra's (2009) recommendations for more meaningful professional development in this area. Additionally, both Antonio and Joey made use of those features central to newer technologies described elsewhere in this chapter (see 2.3), that Pritchett *et al.* (2013) argue have the greatest potential to transform aspects of learning and teaching. Thus, it seems those features can be used to enhance not only pupils learning, but also teachers learning.

Findings from earlier studies by Levent-Ince, Goodway, Ward and Lee (2006) and Thomas and Stratton (2006) also support the narratives of Antonio and Joey (Calderon *et al.* 2017; Gleddie *et al.* 2017) - particularly the notion that professional learning in this area is most effective when it is ongoing and involves colleagues in the process - as opposed to being limited to stand-alone workshops delivered by external providers (Levent-Ince *et al.* 2006; Thomas and Stratton, 2006). The use of social media afforded those practitioners the flexibility to engage in formal and informal professional dialogue with colleagues as and when it suited, and in turn be more responsive to any particular needs or issues they encountered. The teacher's use of technologies such as Twitter and Skype allowed them to connect with colleagues and develop professional

networks that extended beyond the limits of their schools. To such an extent they engaged in dialogue on technology related matters with colleagues both nationally and internationally. As Gleddie *et al.* (2017) highlighted the use of social media and other technologies addressed issues concerning teacher isolation. More specifically, Twitter afforded the practitioners the opportunity to engage with like-minded colleagues, even when there was not any within the immediate departments, faculties and schools in which they worked.

Finally, it emerges the two barriers addressed so far - lack of time and professional development, are somewhat interconnected. Engaging in professional learning with respect to involving technology in one's practice requires considerable investment of both time and effort on a teacher's part (Casey, Goodyear and Armour 2017a). An idea which is apparent in Casey and colleagues description of the teachers they studied having undertaken: *'an intensely personal and emotional learning journey'* as they sought to use technology in their practice (Casey *et al*. 2017a p.249). This notion of a prolonged learning journey was also evident in Hastie's *et al.* (2010) study where the practitioner involved describes an eight month time period between deciding to use technology and actually implementing it. Further support for this idea is provided by Jaime, the practitioner in Parker's *et al.* (2017) investigation who describes spending four months figuring out how best to use a particular piece of software. Finally, given the ongoing advancement and transient nature of technology it is recognised that teachers' with an interest in in this area may have to continue to invest sizeable amounts of time and effort in order to remain up to date, and to know how best to implement new technologies as and when they emerge (Fletcher *et al.* 2017).

2.4.3 Resources

Hew and Brush's (2007) review of 48 empirical studies revealed over 120 barriers affecting teachers' use of technology, with *lack of resources* the most frequently reported issue. It is possible the researcher's broad definition of *resources* influenced this finding - they referred to more than just material resources, encompassing insufficient hardware and software; limited access to technology; lack of time; as well as inadequate technical support to assist teachers' use of it (Hew and Brush, 2007). However, Ertmer *et al.* (2012) maintain that procurement of hardware has steadily increased in UK schools since the turn of the century as a result of recurrent government initiatives aimed at improving technology provision during this time (see Taylor, 2009; Hall and Leigh, 2001; Tearle and Golder, 2008). Consequently, it is claimed that *lack of resources,* or more specifically lack of provision, is no longer a major barrier affecting teachers' use of technology (Ertmer *et al*. 2012). A claim supported by findings from several nationwide reviews undertaken in schools in both England (BECTA, 2006; OFSTED, 2004) and Scotland (HMIE, 2005; 2007) during this period. Those evaluations of the impact government led initiatives had on technology provision found that central funding enabled schools in both countries to acquire sufficient numbers of devices, with OFSTED (2004) reporting *'record levels'* (p.4) of resources at the time. More recent findings by the Organisation for Economic Co-operation and Development (OECD) indicate that globally resourcing has continued to improve, with claims that: *'Students in 2012 were less likely than their counterparts in 2003 to attend schools whose principal reported that instruction was hindered by a lack of computers and computer software'* (OECD, 2016 p.69). Moreover, in 2012 the UK was one of several countries with the highest pupil to computer ratios, with fewer than two pupils to every one device (OECD, 2016).

On the surface findings from those reviews appear positive in terms of provision. However, upon closer examination several underlying issues emerge that reveal ongoing difficulties and oversights associated with resourcing. For example, an initial emphasis on acquiring hardware at the expense of software and other peripherals to use on and with the devices (HMIE, 2007). In addition, the specifications of the devices procured were often inadequate which meant the technology was unable to cope with the software they required (BECTA, 2006; HMIE, 2007). It was also reported that much of the hardware soon became outdated with limited contingency in place for updating or replacing it (BECTA, 2006; HMIE, 2007; OFSTED, 2011). Finally, some teachers claimed there had been an unequal distribution of resources across the curriculum, and some subject areas were being overlooked in favour of others (OFTSED, 2011).

Inadequate infrastructure

If adopting Hew and Brush's (2007) broad definition of what the term *resources* encompasses, other associated issues become apparent, in particular, the inadequacy of the infrastructure - both physical and organisational, in place to support teachers' use of technology. For example, in Scotland it was found that most schools had access to broadband internet by the mid 2000's, but this had only been a recent addition (HMIE, 2007), with the technology itself having been acquired much earlier at the turn of the decade. Furthermore, issues with both the efficiency and dependability of the initial broadband connections available in Scottish schools were reported. Though plans were already established in the mid to late part of the decade to upgrade and supply schools with faster, more reliable, bandwidth internet connectivity (HMIE, 2007).

In terms of organisational infrastructure it is widely recognised that teachers' use of technology is dependent on the availability of adequate technical support services (HMIE, 2007; Judge and O'Bannon 2007; OFSTED, 2004; Wilson and McKinney, 2012). However, it emerged that this aspect that had also been overlooked in the UK during the late 1990's to mid-2000's, with reports indicating that such provision was inconsistent across schools and authorities (BECTA, 2006; HMIE, 2007). Arrangements varied from the involvement of corporate and external services in some schools through to more localised in-house provision in others (HMIE, 2007). Moreover, in the absence of adequate technical services teachers' often assumed such responsibilities, as illustrated in Davidson & McQueen's (2006) study, where one practitioner commented: *'I've learned to be a brilliant technician…'*(p.6).

Limited vision or strategic overview

Various centrally funded initiatives available at the end of the 1990's and the early 2000's, such as the National Grid for Learning (DfEE, 1997) and *Laptops for Teachers* scheme (see BBC Education 2002 January 9th), initiated a period of rapid procurement of hardware in schools in the UK. However, the acquisition of technology during this time seems to have been unsystematic and characterised by a lack of vision, or formal long-term strategy (BECTA, 2006; HMIE, 2007). Moreover, this trend seemingly continued into the latter part of the decade with OFSTED (2011) reporting that in many schools at this time there was little evidence of staff, managers and governors evaluating the impact of their previous spending on technology. Nevertheless, despite a perpetual lack of forethought and strategic planning, it was found that those responsible for school budgets were becoming more conscious of the ancillary costs involved, as well as the importance of support services and infrastructure for the

successful integration of technology (OFSTED, 2011). Despite a raised awareness of the importance of such provision and the associated costs involved, more recent studies undertaken by the National Educational Research Panel (NERP) and TALIS indicate that little progress has been made in the intervening years (OECD, 2015b; BESA, 2018). For example, 66% of 366 Secondary schools in the NERP survey felt they were still ill equipped in terms of their technology infrastructure (BESA, 2018).

Resourcing - PE

Turning attention once more towards PE, the nature and purpose of the subject, as well as its status within the curriculum, have resulted in PE teachers having to confront unique issues with respect to resourcing. Firstly, it emerged that government initiatives launched during the late 1990's and early 2000's had limited impact on technology provision in PE in comparison to other subject areas. Subject specific reviews and school inspections focussed on technology use in PE undertaken at this time revealed a dearth of hardware in PE departments (BECTA, 2005; OFSTED, 2002; OFSTED, 2004). This lack of provision was initially attributed to the subject not being considered a priority area within the curriculum - which was reflected in the distribution of funding and resources (Miller, 2012; Tearle and Golder, 2008). Though, other reasons emerged, for example, subject specific devices and software, such as video analysis packages like 'Dartfish' proved too costly (Casey and Jones, 2011). Additionally, those technologies often required high-levels of technical expertise and training to operate (Palao *et al*. 2015; Tearle and Katene, 2005) - a point which may in part explain why PE departments who were reportedly well-resourced used technology infrequently (BECTA, 2005). Findings also indicated those particular schools only ever used their technology for showcasing purposes, for example during government

inspection visits (BECTA, 2005) or photographs of it in the schools prospectus (Halpin, Power and Fitz, 1997). Though it is not possible to determine how those departments were able to procure their resources, Eberline and Richard's (2013) findings provide a plausible explanation. The author's maintain that PE teachers need to be proactive and resourceful when it comes to acquiring technology: *'Teachers must pursue creative ways to fund programming needs beyond their typical school allocations'* (p.39). A point supported and exemplified in the BECTA (2005) report where a PE teacher reportedly painted a section of wall in the games-hall as a low-cost alternative to a projector screen. Additionally, Chambers *et al.* (2017) highlight an instance where a PE teacher acquired an unwanted computer from another department within his school, and describe how they used it to publicize the department's extra-curricular program. Finally, despite some schools being well-resourced in more general terms as a result of government schemes and funding, accessing the technology was often problematic for PE departments, as well as other subject areas. In particular, arrangements which included computers and other peripherals being housed in dedicated suites or classrooms left them inaccessible and of limited value to some subject teachers (OFSTED, 2004).

Before proceeding to consider more recent developments, it is worth noting that policy writers should be apportioned some of the blame for the initial lack of resourcing, as well as the profession's hesitancy towards technology (Tearle and Katene, 2005). In England PE was the only subject in the early National Curriculum guidelines that was formally excused from having to incorporate technology (Tearle and Golder, 2008). Similarly, in Australia funding and resources were initially allocated for certain subject areas, namely English, Maths, History and the Sciences (Miller, 2012). However,

policy changes as well as advancements in technology have provided PE department's scope to overcome some of the early issues encountered in the 2000's (Tearle and Golder, 2008). More recent developments in mobile technologies have meant that devices and software are now available which better meet the requirements of PE (Barrett, 2014; Taylor, 2009; Herold, 2013, Tearle and Katene, 2005). For example, mobile technologies are more suited to the practical environments encountered in PE, such as the games hall, astro-turf and swimming pool, thus removing the constraints of previous desktop, fixed wire technologies (Gubacs-Collins and Juniu, 2009). Consequently, many of the initial resourcing issues in PE, namely *'...availability, affordability, access and relative simplicity of use...'* of technology are diminishing (Tearle and Golder, 2008 p.58), to such extent that it is suggested that the initial hesitancy in the profession has been replaced by increased awareness and enthusiasm for technology (Cengiz, 2015).

Infrastructure - PE

Having established at the outset of this section that any discussion on resourcing should consider more than just the acquisition of material resources, matters pertaining to both the physical and organisational infrastructure in PE will now be considered. Some of the issues relating to infrastructure, considered in more general terms elsewhere, reappear in the PE literature. At first glance these findings may be expected and somewhat unsurprising. Nevertheless, it is worth remembering the PE profession was slow to commit when schools first came to consider implementing technology - for reasons acknowledged in the previous section (see p.35-36). It is possible this delay could have been advantageous allowing PE practitioners to learn from other subject teacher's earlier encounters with technology. Moreover, it could be argued that PE

departments should have been more alert to resourcing issues before they arose, and not have made similar mistakes to colleagues in other subject areas who were first to involve technology. Unfortunately, findings indicate this was not the case.

Physical infrastructure - PE

In terms of physical infrastructure, findings reveal that PE facilities are often poorly served with regard to internet and WiFi connectivity. As a result both teachers and pupils are unable to link available devices to school networks and servers, in turn limiting the value of the technology (BECTA, 2005). The lack of such substructure has been attributed to the location of PE departments, as well as the nature and purpose of their facilities (Thomas and Stratton, 2006) - in particular their *'structural separateness'* from the rest of the school (BECTA, 2005 p.4). Moreover, the age and state of many PE facilities have proved problematic (Pyle and Esslinger, 2014), with it not cost effective to *'retrofit'* older gymnasia in order to bring them in line with other subject areas (BECTA, 2005). Finally, Kretschmann (2015b) provides a sense of perspective on such issues, and highlights that issues with respect to physical infrastructure are still prevalent, citing the simple matter of limited power outlets being available in the practical spaces used to teach PE.

Organisational infrastructure - PE

Results from the PE literature support more general findings discussed previously (see p.33-34), particularly the need for ongoing technical support in order to implement technology on a day to basis (Tearle and Katene, 2005). In some instances, PE practitioners argued for dedicated technicians to be employed within their departments (Thomas and Stratton, 2006). Though, more often access to technical services in PE has been limited (OFSTED, 2004; Tearle and Golder, 2008). Reasons why specialist

support was underprovided for in PE are not revealed in the literature. However, it is conceivable the lack of funding and prioritising of technology in PE, as discussed previously (see p.35), would in part explain such a deficit, as would the lack of any systematic long-term planning and strategizing with respect to the use of technology in PE reported by OFSTED in 2002 and again in 2004. At the time the inspectors recounted that too often: *'...plans are superficial and rely simply on acquiring resources without a clear rationale for their use…'* (OFSTED, 2004 p.9). Again an apparent emphasis on purchasing devices meant other important factors such as the physical and organisational infrastructure required, ongoing professional development, and the time to both learn and implement technology were overlooked and not accounted for.

Thus far, the discussion has focused on more immediate matters concerning technology use in schools. In keeping with the wider purposes of the study the following section will step back and consider broader issues to do with schooling and technology. In particular, the discussion will examine the socio-economic and political backdrop, and consider how those aspects might influence teachers' practices with it.

2.5 Ideological matters

This final section may at first appear to deviate from the main thrust of the chapter. Thus, in order to put the following discussion into context it is worth recalling the overarching aim of the study outlined previously in Chapter 1 (see 1.6), namely to examine teachers' everyday practices and habits with technology on multiple levels. More immediate matters associated with teachers' use of technology (see 2.3) and

the local contexts in which they practice (see 2.4) were considered elsewhere in this chapter - what I regard as micro and meso level concerns. In response to Selwyn's (2017 p.vi) call-for developing a greater awareness of *'bigger picture'* issues, attention will now turn to consider macro level matters, with a particular focus on the current rhetoric that accompanies technology and schooling. The discussion will first describe the nature and manner of the discourse that prevails, before revealing the principle voices involved, their intentions, as well as the mechanisms by which they have managed to influence current arrangements regarding the positioning and use of technology in schools.

2.5.1 Value

The value and importance currently afforded to technology in schools is apparent in the recurrent launching of bold national policies and initiatives such as: the UK's National Grid for Learning (NGfL) in the late 1990's (DfEE, 1997), the New Opportunities Fund (NOF) Training for Teachers Programme (NOF, 2000), and more recently the Year of the Code project (Gov.UK, 2014). Further confirmation is evident in the ever increasing stream of funding available to underwrite such projects, and in turn supply schools and teachers with appropriate resources and training. For example, in the UK alone over £1 billion was spent on technology up until 2002 (Hall and Leigh, 2001), with more recent projections suggesting that over half this figure (approximately £600 million), was spent on technology in UK schools during the 2014-15 academic session alone (Collins and Higgins, 2013). In trying to explain this ongoing and increased emphasis on technology and schooling Selwyn (2016) acknowledges the involvement and role of the private sector:

> In one way or another, commercial influences have a hand in most of the recent high-tech education reforms and initiatives. Indeed, if one takes time to 'follow the money', then high-tech firms are involved as supporters and promoters of most – if not all - recent educational technology developments and big ideas.
>
> p.121

Parton and Light (2010) and Selwyn (2014) elaborate, maintaining the agendas of government funded initiatives are highly politicized, recognizing they are often accompanied with a rhetoric based on the transformative potential of technology, as well as a need for modernisation of the education system.

2.5.2 Rhetoric

There is consensus among many social scientists regarding the language and discourse associated with technology and schooling, namely that it is vacuous, overly enthusiastic and excessive (Buckingham, Scanlon and Sefton-Green, 2001; Conlon and Simpson, 2003; Selwyn, 2016; Selwyn, Nemorin, Bulfin and Johnson, 2018). Those authors are united in their scepticism of the inflated commentary that prevails and question claims in relation to the benefits of using technology, however, they recognise such suspicion is not routine:

> Unfortunately, many people continue to present school technology use in black-boxed terms - that is, as an inherently 'positive project' fuelled by an underlying belief that digital technologies must be capable of improving learning, teaching, administration, leadership and so on.
>
> Selwyn *et al*. (2018 p.10)

In terms of the nature of the discourse that abounds educational technology it is maintained that much supporting evidence is anecdotal (Buckingham, 2007; Selwyn, 2016; Selwyn *et al*. 2018). Moreover, Selwyn *et al.* (2018) acknowledge the positive

findings reported in the research is often the result of exceptional, atypical use of technology - a point arguably confirmed in the previous chapter (see 1.4.2).

In respect of the over enthusiastic and excessive nature of the discourse, Buckingham (2007) insists much research is prejudiced as a consequence of being conducted by devotees of technology. A claim somewhat supported more recently by Gard (2014), who highlights those who pursue more erudite and critical agendas have gone quiet as interest and enthusiasm for technology use in schools has gathered momentum. Given the reported lack of sustained critical social research on education and technology (Sewlyn, 2011; Selwyn *et al.* 2018), it is possible those voices have been drowned out by a larger body of research undertaken by technology enthusiasts, whose findings are often framed in more positive and persuasive ways (Selwyn, 2016).

Stepping further back from matters concerning the perceived value and rhetoric associated with technology and education brings other, potentially more influential stakeholders into view. Influential in the sense those stakeholders are able to determine the nature and direction of key debates in this area, as well as their ability to disseminate their arguments more widely. Sewlyn *et al.* (2018) claim the existence of a lobby of educational technology proponents made up of retailers, software publishers, academics researching in this particular area, as well as practitioners who regularly use it. Furthermore, Selwyn and colleagues maintain this alliance has been increasingly instrumental in shaping the current arrangements in education whereby technology is viewed in both enthusiastic and optimistic terms. However, Conlon and Simpson (2003) suggest that a more powerful, tactful coalition between the major corporations that design and supply technologies used in schools, as well as politicians

and educational policy makers has been forged (Conlon and Simpson, 2003). Moreover, they claim their respective messages are more authoritative and widespread, being rendered through indelicate sales pitches and appeals to the public focussed on societal and economic needs. Turning attention back to Scotland, such hyperbole is apparent in the Scottish Government's national strategy for technology published at the start of this decade: 'A Digital Ambition for Scotland' (2010) and 'Scotland's Digital Future' (2011), as well as policy documentation that accompanies Curriculum for Excellence (CfE) (Education Scotland 2009a). Each of the policy documents make explicit reference to, and emphasise the connective, collaborative and creative capabilities of digital technologies not only in the field of education, but across all areas of Scottish society and beyond. Whereas the educational policy emphasises the acquirement of digital skills within young people in order to meet the challenges of modern society (Scottish Government, 2009a), the wider policies emphasise the notion of technology increasing production and performativity to ensure the nation retains an important position within the global market place (Scottish Government, 2010 and 2011). In terms of major corporations, many of those same themes are prominent in the marketing materials used to promote their technologies within the education sector - as illustrated in a recent Apple Inc. campaign that makes explicit reference to how their devices promote creativity and prepare users to succeed in contemporary society:

> Ignite the creativity in every student. Every child is born full of creativity. Nurturing it is one of the most important things educators do. Creativity makes your students better communicators and problem solvers. It prepares them to thrive in today's world - and to shape tomorrow's. For 40 years, Apple has helped teachers unleash the creative potential in every student.
>
> Apple Education [online]

Another feature of the current rhetoric is the notion of *'hubris-driven solutionism'* (Selwyn *et al*. 2018 p.15) - that is the assumption technology is beneficent (Bromley, 1998). Though, it is recognised the corporations, politicians, policy makers and others circulating such a message rarely dwell on, or provide exact detail about what the problem is in the first instance (Buckingham, 2007, Gard, 2014). Using GLOW - Scotland's digital network for schools as a case in point, the discourse that bounds the initiative (which is funded by the Scottish Government, and managed by Education Scotland in collaboration with the technology company RM Education), is one that focuses solely on benefits and intended outcomes (Conlon, 2008):

> Glow offers a number of tools and services to help you as an educator to enrich and enhance learning across the curriculum. You can share teaching materials, design online resources and activities to engage learners and take part in professional learning opportunities.
>
> GLOW Connect [online]

Before proceeding to examine the motives of the different parties involved in this coalition it is worth recalling many of the themes addressed elsewhere in this chapter, namely teachers' motivations for using technology, as well as the barriers to its use. Though not explicitly reported in the literature it is likely the rhetoric associated with technology and schooling may implicitly prompt teachers' to use it (see 2.2), influence their practices with it (see 2.3), as well as circuitously bringing about many of the reported barriers (see 2.4). These ideas will be revisited and discussed further in Chapter 6.

2.5.3 Power and control

Having established the persuasive nature of the dialogue that accompanies technology use in schools, as well as the principal voices involved, the power and control that these public-private alliances possess as a result will now be considered. It is suggested that technology companies, politicians and policy makers use both their authority and jurisdiction to further their own agendas by surreptitiously influencing the devices and applications employed in schools (Selwyn, 2014). Moreover, it is argued the private sector has reaped the greatest benefit from such partnerships strengthening their position in the market, and consequently their ability to exert greater influence at government level (Buckingham, 2007). For example, consider RM Education - part of the previously highlighted GLOW partnership in Scotland. The financial profit alone to be gained by this private group is significant - with the initial spend on the system in excess of £40 million at the time of its inception (Conlon, 2008), with more recent figures indicating a total-spend in excess of £69 million (Seith, 2017).

Brookfield (2005) acknowledges that to ensure their existence, multinationals, in this instance technology companies such as Apple inc. and the Microsoft Corporation, are reliant on the public at large believing the products and services they provide are necessary in order to lead a successful and satisfied existence. Applying these ideas to education, technology companies are dependent on teachers, parents and pupils believing being their products will enhance or even transform their schools and schooling (Buckingham, 2007; Conlon and Simpson, 2003). Assurances are subsequently delivered by Governments who position those same technologies within their educational policies and curricula, such as CfE in Scotland (see 1.3), and associated initiatives, such as the aforementioned GLOW platform (see 1.3). This support, alongside the ring fencing of monies for technologies - such as NGfL (DfEE,

1997) and the NOF funding (NOF, 2000), arguably strengthens the furtive alliance between the developers and providers of technologies used in schools and educational policymakers and politicians, affording them greater power and control.

2.5.4 Hegemony

Williams (2002) acknowledges: *'Real power is political, economic, social power, and while it is crucially influenced by ideas, it will be so only if those ideas have some authority'* (p.9). An idea that corresponds with the notion of hegemony and the importance of persons approving and adopting ideas and practices that seem perfectly normal, but in fact oblige the interests of those in positions of power - in this case the partnership between the politicians, policy makers, technology developers and providers (Selwyn, 2014). A conceivable explanation for why people are quick to accept ideas that are discernibly fallacious is provided by Eagleton (1991). He argues that in order for ideology to function effectively it must connect with peoples' wants and desires, as well as retaining elements of truth. Applying Eagleton's (1991) ideas to the system of beliefs that currently abound technology and schooling, stakeholders aspire for practitioners and pupils that are motivated and effective. Moreover, they assume those attributes and capacities, if acquired, will result in increased levels of achievement and attainment. There is evidence of these ends being met through the employment of technology in other sectors, for example business and industry (Brynjolfsson and Hitt, 2000; Ghosal and Nair-Reichert, 2009; Sircar and Choi, 2009; Issa, Isaías, Kommers, 2016), as well as society more generally, with technology making everyday habits *'more efficient, more convenient, or just more fun'* (Kraut, Brynin and Kiesler, 2006 p.4). Such evidence provides a degree of truth that transmits and supports school leaders, teachers, parents and pupils' beliefs regarding the

potential for technology to improve or transform aspects of schooling. Thus an ideology has developed where technology is now concomitant with perceptions of a quality education. Though accepted as an integral and inevitable aspect of modern schooling, as a result of its ubiquity, technology is now considered an everyday, unremarkable feature of learning and teaching (Selwyn, 2014; 2016; Selwyn *et al*. 2018). Consequently, for many the use of technology in schools does not provide cause for concern and requires little or no debate (Selwyn, 2014). Furthermore, when questions are asked of technology it is acknowledged that they are often practical and technical in nature, and based on the assumption that it is beneficial, for example: how can its potential be harnessed, or how it might be used more effectively (Selwyn, 2014). Thus, the current arrangements in schools, which have been determined by the technology companies, politicians and policy makers, have meant technology has become a background feature in schools (Selwyn *et al*. 2018). Moreover, those arrangements permit the use of technology in schools to elude sustained critical analysis, to the benefit of the providers and politicians (Selwyn *et al*. 2018). Finally, it is my intention to take into account this ideological context and matters concerning value, power and control and hegemony in my own analysis of teachers' use of technology in PE in subsequent chapters.

2.6 Summary

The aim of this second chapter was to establish the more specific purposes of the study. In order to do so findings from the literature relating to teachers' motivations for using technology, current practices with it, as well as common barriers encountered by them were examined. The latter discussion considered a range of wider socio-political issues relating to technology and schooling, namely the perceived value of technology, the

rhetoric that accompanies it, as well as matters concerning power, control and hegemony. The chapter emphasises a need for further research in these areas in order to:

- Develop a broader understanding of secondary PE teachers in Scotland's everyday habits and practices with technology that extends beyond the current and 'best' practices frequently depicted in the research literature, with a particular focus on lead users.
- Develop a more nuanced understanding of the reasons why secondary PE teachers in Scotland use technology, again focusing on lead users.
- Develop an understanding of immediate as well as wider factors that may directly or in-directly determine lead users' everyday habits and associated practices with technology in secondary school PE in Scotland.

Chapter 3 Methodology

3.1 Overview

Having established the need for my study in Chapters 1 and 2, the following chapter will describe the qualitative research design and methods I employed. On occasion I will draw on findings from those earlier chapters in order to demonstrate how they informed decisions taken with regards to the design, for example the use of grounded theory, as well as the instruments and strategies used in the study, for example the use of on-site, semi-structured interviews. After an initial discussion on ethical matters, the philosophical underpinnings of the study will be examined, followed by an overview and rationale for the methodological approach used. The latter discussion provides an account of particular methods and strategies used with regards sampling, data collection and analysis, along with reasons for doing so.

3.2 Ethical matters

Iphofen (2009) claims that when research impacts upon people's lives, ethical issues will arise. Elaborating on this point Iphofen (2009) accepts the impact can be both positive and negative and that: *'...the potential for harm must always be considered and balanced against the potential for benefit...'* (p.29). Though such matters were considered at the outset, given the qualitative nature of my study I also understood the need to consider ethical issues throughout the research process (Iphofen, 2009). Thus, decision making on ethical matters was ongoing, with continual reflection on my part so as to be alert to possible issues (Iphofen, 2009). For example, in the advanced stages of data collection, after several failed attempts at organizing a follow up interview with a participant, I took the decision not to pursue them further. Although frustrated, I

understood my ethical obligation to allow them to refuse to take further part without explanation (Weiss, 1998).

Informed consent

Prior to commencement of the study ethical approval was sought from relevant University authorities. This proved to be a straightforward procedure given the arrangements outlined in the application concerning informed consent, as well as the measures taken in relation to confidentiality and participant anonymity (See Appendix A). Written informed consent was obtained from participants in advance of their first interview - each was sent a formal letter of consent, and information sheet about the nature and purpose of the study (see Appendix A).

Confidentiality and anonymity

In relation to confidentiality all data gathered during the investigation remained private and stored in a secure manner in line with the University of Edinburgh's (UoE) data protection policies (see UoE Research Data Management Policy - May 2011). To ensure anonymity, names of participant's and their schools were changed to conceal their identities (see Table 1.0 for participant pseudonyms). It is acknowledged that ensuring participants' identities are not unknowingly revealed can prove challenging in qualitative research (Thomas, 2013). This is a salient point given the nature and context of my research, namely the size and close-knit nature of the PE community in Scotland, as well as the reporting procedures used. Though, necessary care was taken to ensure that quotes or practices reported in the research did not unwittingly reveal the participant's identity (Greener, 2011).

3.3 Grounded theory

The discussion that follows presents a rationale for why methodologically my study was guided by the ideas of Charmaz (2006) - in particular her constructivist interpretation of Glaser and Strauss's (1967) grounded theory. Before justifying my methodology from an ontological and epistemological perspective, Cresswell (2009) maintains that grounded theory is relevant in the absence of any existing theory or framework to explain and understand the phenomenon being considered. Returning to findings presented in the opening chapter (see 1.2.2), the use of such an approach appears warranted given Oliver (2013) and Costa's *et al.* (2017) observations that there has been limited theoretical advancement of the field, and their appeal for more abstract accounts of technology use in education in order to gain fresh perspectives in this area.

3.4 Philosophical matters

At the outset I understood it was important to ruminate over my own views concerning reality, and what I considered to be 'truth'. Furthermore, any assumptions that I held, particularly those associated with how I view and interpret the world, needed to be taken into account, as they would impact on aspects of the study, particularly the research design and methods employed (Cresswell, 2013; Guba and Lincoln, 1989). Clarification of the philosophical foundations of the study would help establish the soundness of the research, and enhance the credibility of my findings (Crotty, 1998). Deliberation over such matters would also ensure the purpose and aims of the research were better met as a result of greater compatibility and congruence between the research questions, study design and subsequent methods employed (Cohen *et al.* 2011; Gratton and Jones, 2010; Whittemore *et al.* 2001).

Three broad philosophical matters were considered at the outset of the inquiry: the notion of multiple realities; what should be considered 'truth', and finally my own position within, as well as influence on, the research process. Attending to those questions allowed me to understand better my own ontological and epistemological orientations - what I believe constitutes reality and valid knowledge. Furthermore, this allowed me to consider how reality may be understood and such knowledge obtained. Each of these matters will now be considered in order to demonstrate how my orientations influenced my decision to pursue a line of inquiry founded on constructivist conventions, namely employing a postmodernist form of grounded theory favoured by Charmaz (2014), and Clarke (2005).

3.4.1 Multiple realities

The constructivist paradigm assumes that we each develop our own unique perspective of an experience, making sense of it by creating our own schemes, models and concepts which can be recalled, reconstructed (as we encounter similar and new experiences), and even shared with others (Schwandt, 1998). Meaning is formed through engagement, interaction and interpretation of the immediate, as well as the wider environment in which one is situated. Therefore, carrying out research within the constructivist paradigm requires an understanding of the realities that people have developed and inhabit, as well as the perspectives they hold. Furthermore, it requires researchers to examine and comprehend lived experiences of those being studied (Cresswell, 2009; Schwandt, 1998). Charmaz's interpretation of grounded theory is deemed fitting for my study as it does not attempt to seek a single, universal, enduring truth. Rather it recognises the existence of multiple realities, and that meaning is subjective, ever changing and influenced by time, location, situation and culture

(Hildenbrand, 2007; Charmaz, 2006) - features that are in accordance with my ontological stance and the theoretical lens used in the study. The importance of situation is given more prominence in Clarke's (2005) take on grounded theory, with the context, as well as actions and processes, subjected to what she refers to as a 'situated analysis'. However, it is the recognition and emphasis placed on non-human elements within the environment, in this instance technology, and its capacity to influence and act upon the environment that adds to the suitability of Clarke's variant of grounded theory.

In my study I assumed each participant would hold unique perspectives, and attach different meaning to their experiences and practices with technology. The intention was to find out how their interpretations, and associated behaviours had developed, as well as how they have been influenced by aspects of the immediate and wider environment in which they practiced, such as their department, school, local authority, educational policy (see 1.3 and 2.4), in addition to wider more ideological matters and thinking around technology and education per se (see 2.5).

In order to understand my participants' interpretations and realities, I appreciated a need to become accustomed with the environments in which they practiced. This would allow me to consider the impact their immediate setting, as well as the wider educational and socio-political climate in Scotland (and beyond) may have had on shaping their habits and practices with technology. Also, it would be important to reveal the actions and processes by which their meanings (with respect to technology) had been constructed, negotiated, and personified. This could be achieved by examining the everyday language they use, the definitions attached to situations, as

well as their behaviors with technology (Schwandt, 1994, 1998). However, there are challenges and difficulties in doing so, in particular the surfacing and interpreting of the tacit meanings as well as the understated actions and processes of the teachers - what Leigh-Star (2007) refers to as revealing the invisible within a task. Appreciating that I would have to contend with a range of interpretations - that could be confirmatory as well as conflicting, led me to consider matters concerning what should be considered 'truth' within my participants accounts and my interpretation of them.

3.4.2 Truth

My constructivist ideals suppose 'truth' to be a construction or interpretation that is sophisticated and well-informed (Schwandt, 1998), both in terms of the quality and amount of information used to construct it (Guba and Lincoln, 1989). Furthermore, this interpretation is one that can be shared with others, and in turn strengthened when consensus exists about it (Guba and Lincoln, 1988, Schwandt, 1998). Moreover, I acknowledge that constructions are malleable and can be refined in light of novel experiences, and as a consequence become more informed and sophisticated (Guba and Lincoln, 1989). This is arguably a salient point given the focus of my study. The transient nature of technology, namely the recurrent development of new hardware and software will mean participants are likely to encounter new technologies and experiences in future that could influence their current assumptions and practices with it.

In order to determine the 'truth', I realised I would have to involve methods that allowed me to access, then disentangle and organise the sophisticated constructions of my participant's reality. My methods would also need to provide both detail and volume of information as regards participants' experiences and practices so as to

accurately represent their realities. Also, in realising this goal, any subsequent analysis and interpretation of the data, what Schwandt (1994) refers to as a construction of constructions, was dependent on my own unique understandings and readings of what is observed and heard during my interactions with participants (Sinkovics and Alfoldi, 2012). Thus, I understood meaning is not something to be discovered within my data, or simply acquired by entering the participant's setting. Instead, findings would be developed as a result of my interactions with the data. Charmaz (2006) emphasises that knowledge, or 'truth', is not something to be discovered, rather it is assembled from one's data. Consequently, any theory developed is grounded in the data, and is a co-construction of the inter-subjective meanings of the participants and the researcher - what Schwandt (1998) refers to as a *'...construction of the constructions of the actors one studies'* (p.22). Guba and Lincoln (1998) also highlight the importance of this interface and interconnectedness between the inquirer and inquired when they state: *'It is precisely their interaction that creates the data that will emerge from the inquiry'* (p.88). I also realized such matters needed to be taken in to consideration when determining my sample size. Though wanting to involve a number of teachers in order to develop as broad and rich an understanding as possible, I understood the challenges associated with having too many participants. A primary task would be teasing out the unique situated perspectives held by each participant. This undertaking in itself is challenging and time consuming, but matters are compounded when bringing together the multiple realities of many into something akin to an adjoined perspective (Guba and Lincoln, 1998). Finally, given that any resultant theory would be co-constructed, namely my rendering of the participants interpretations, I was conscious that I would need to be aware of my own position within the research process.

3.4.3 My position

As a frequent user of technology in my own teaching practice, I knew it would be difficult to prevent my own assumptions and biases from influencing the study. However, Charmaz (2006) does not perceive the researcher as a distant, neutral observer within the research process. Instead she believes they are actively involved in gathering and subsequently assembling an understanding of the phenomenon being investigated. Charmaz (2014) states: *'We stand within our research process rather than above, before or outside it…'* (p.321), and any interpretation is a composition that reflects the researchers view as well as that of the participants (Hildenbrand, 2007). Awareness of my own position within the study, and knowing that I cannot detach myself from the process is a central tenet of constructivist approaches to grounded theory (Holton, 2007). Charmaz (2014) believes a researcher's previous experiences, prior assumptions, extant ideas and disciplinary perspectives should all be acknowledged, and indeed embraced. Furthermore, like O'Neill-Green *et al.* (2007), she maintains they are advantageous to the development of a richer understanding of the area being studied. These ideas are important given my own experiences as a PE practitioner, as well as someone who regularly uses technology in their day to day teaching. In addition, my prior and ongoing engagement with research literature in this area meant that I brought a level of expertise to the research. However, a constructivist perspective allows me to bring this knowledge and experience into the process, and as result become a *'primary instrument'* within the study (Locke, 2007; Lempert, 2007; Clarke, 2005).

3.5 Participants

It is suggested initial matters concerning participant selection should focus on the purpose of the research and the research question(s) (Maxwell, 2012; Punch, 2014; Savin-Baden and Howell Major, 2013). Thus, my decisions about sampling were primarily guided by what I wanted to know, from whom, as well what I wanted to accomplish. On this basis a sampling plan was devised, following Miles and Huberman (1994) and Miles, Huberman and Saldana's (2014) recommendations that samples should be: relevant, representative, and feasible with respect to time, resources and accessibility. Aware that I would be exercising a degree of judgement with regards individual participant selection (Gray, 2013), a rationale and criteria was established in order to guide my decision making (Savin-Baden and Howell Major, 2013).

3.5.1 Purposive sampling phase

Punch (2014) acknowledges the process of identifying and recruiting the right participants for a study is often progressive, and can involve multiple stages. I realised my sampling strategy would need to be flexible, and employ different approaches in order to determine and enlist appropriate participants (Gray, 2013; Savin-Baden and Howell Major, 2013). Purposive sampling was initially undertaken - a theory driven approach where participants are selected ahead of the research based on their background and experiences, and on the assumption that they would be able to provide a meaningful insight into the area investigated (Esterberg, 2002; Punch, 2014; Silverman, 2006).

3.5.2 Selection criteria

A primary objective was to recruit participants that were *'lead users'* of technology (von Hippel, 2005), namely secondary PE teachers recognised by their peers as being

front-runners in this area, and who regularly employed technology in their day to day teaching practice. The first step involved identifying teachers who matched this broad profile. I began by recalling names of teachers who had delivered presentations or led workshops on technology use in PE at professional learning events that I had previously attended, such as the Scottish Association for Teachers of Physical Education's (SATPE) annual conferences in 2014, 2015 and 2016; Education Scotland's pedagogical approaches to support National Qualifications event in 2015, and the City of Edinburgh's ICT in PE twilight CPD workshop in 2014. During this process, I began to determine selection criteria for my participants, namely an involvement in the delivery of professional learning related to the use of technology in PE. Additionally, I sought participants who were recognised by the profession for their knowledge and proficiency with technology. I supposed leading professional learning was an acknowledgement of each teacher's knowledge and expertise in this area, with many of the events organised by recognised educational bodies and associations.

3.5.3 Prior knowledge of participants

Having observed potential participants deliver a workshop or presentation was helpful in determining their suitability for my study. Firstly, their workshop gave indication of their knowledge, experience and skills using technology within PE. On this basis I supposed each participant identified would be able to provide the information I sought. However, despite their suitability Maxwell (2012) and Morse (2007) highlight a key consideration in studies of this nature is the availability and willingness of participants to take part. This was a slight worry given ongoing concerns about teacher workloads in Scotland at the time (SEJ, 2015). Finally, the teacher's workshops also gave

indication of their ability to articulate and express their knowledge and experiences using technology. As Maxwell (2012) and Morse (2007) acknowledge, a participant's capacity to communicate and convey their beliefs, ideas and practices in a lucid, coherent fashion is vital in aiding qualitative researchers to develop clear and comprehensive understandings of the phenomenon under investigation.

The purposive sampling phase resulted in the identification of five participants, four of whom were recruited to take part in the study (one declined due to work related commitments). Recruitment was a straightforward process with initial contact made via email to gauge participant interest and availability to take part, before proceeding with more formal arrangements. The immediate interest expressed by the four participants, as typified in Charlie's response below, alleviated my initial concerns about their availability and willingness to participate in the study:

> More than happy to be involved…I think the research you are conducting sounds great and would be delighted to have as much involvement as possible…could certainly devote some time to this.
>
> Email received 13th October 2015

One further participant, Keith, was recruited during this initial phase, but under different circumstances to the others. I encountered Keith as an undergraduate PE student on the Initial Teacher Education (ITE) course I taught - providing tutorial support for his fourth year dissertation focused on PE teachers' attitudes towards technology. I met Keith at an Education Scotland technology related workshop in June 2015 (he was attending as a delegate), and enquired if he was still using technology in his teaching. Keith revealed that his knowledge and experience with technology had helped him secure his current teaching post. Despite having not been involved in the

delivery of professional learning like other participants, his undergraduate research, as well as securing employment as a result of his knowledge and expertise using technology, was justification for involving him in my study.

3.5.4 Sampling concerns

Upon completion of the purposive sampling phase I had two immediate concerns. Firstly, the size of the sample, with only five participants recruited. Secondly, the representativeness of the sample - all of those recruited were male secondary PE teachers. However, Charmaz (2006) maintains grounded theorists should not strive for representative samples, or concern themselves with matters to do with generalizability. Instead, the focus should be on the adequacy of the sample. Therefore, my aim should be to recruit a sample that would enable me to develop a rich, insightful theory, with refined, elaborate concepts that remain true and consistent across the different contexts, settings and participants in the study. I was concerned that my current sample would not allow me to generate such theory, and so decided to recruit further participants.

A dilemma in qualitative research is that too many participants may make the extraction of rich, thick data unrealistic (Gray, 2013). Additionally, larger samples can be overwhelming for a researcher, resulting in sizeable data sets that are unmanageable, and increased likelihood of important aspects being lost during analysis (Stern, 2007). Conversely, having too few participants in a study can lead to thin data sets, challenges with achieving data saturation resulting in a limited conceptual understanding of the phenomenon being studied. With only five participants recruited after the purposive sampling phase, the latter points about a less convincing data-set and incomplete understanding were my main concerns. Different

locations and context had been addressed in my initial sample, namely the five teachers worked across four different local authorities, and their respective schools were distinctive in terms of pupil rolls, and school locale (see Table 1.0). However, some groups were absent, or not adequately accounted for in the sample, namely female participants, other main grade, un-promoted teachers, as well as early career practitioners. Finally, pragmatic concerns such as time, access and cost, also had to be taken into account and ultimately influenced my decision with respect to the eventual number of participants involved in the sample (Maxwell, 2012; Savin-Baden and Howell Major, 2013).

Table 1: Overview of the sample

	Sample - Phase 1					*Sample - Phase 2*			
PARTICIPANT	Brian	Mick	Charlie	Bill	Keith	Faye	Linda	Shirley	Ronnie
Gender									
Male	x	x	x	x	x				x
Female						x	x	x	
Age									
20-29 years		x			x	x	x	x	x
30-39 years	x		x						
40-49 years				x					
Teaching Experience									
Early Career (0-3 years)		x			x		x		x
Early to Mid (4-7 years)						x		x	
Mid (8-15 years)	x		x						
Mid to Late (>15 years)				x					
Current Position									
Main Grade Teacher		x			x	x	x	x	x
Principal Teacher	x		x	x					
SCHOOL									
Size (school roll)									
Small (<500 pupils)								x	
Medium (501-1000 pupils)	x					x	x		x
Large (>1000 pupils)		x	x	x	x				
Location(population)									
Large Urban Area >125k	x			x	x	x	x	x	
Other Urban Area >10k			x						x
Accessible Rural Area <3K		x							

*'Participant' data was obtained from the 'Background Information' form completed prior to interview (see Appendix B).

** 'School' information obtained from most recent schools dataset (September 2015) available online from the Scottish Government (2015b).

3.5.5 Snowball sampling phase

In order to address concerns over the adequacy of my sample I adjusted aspects of my sampling plan (Savin-Baden and Howell Major, 2013). This involved revising my selection criteria and employing a different strategy - snowball sampling. This approach involves those previously recruited acting as informants who recommend others they believe would complement the study (Esterberg, 2002; Robson, 2011).

Those initially recruited were asked if they knew of any PE colleagues, particularly female and early career teachers who used technology in their everyday teaching practice. The response was positive, with a further four participants being recruited - three females and one male.

By the end of the second phase a sample of nine secondary PE teachers, three female and six male, across five different local authorities were recruited (see Table 1.0). All participants were recruited in advance of data collection, as opposed to being enlisted throughout successive stages of the study. The capacity to increase the size and nature of the sample as a study proceeds is a feature of grounded theory methodology (Charmaz, 2006; Clarke, 2005). However, I decided the nine teachers recruited were sufficiently diverse in terms of their backgrounds, as well as their locations and settings (see Table 1.0).This would allow me to draw comparison between the participants, their contexts and settings, in order to construct, illuminate and substantiate my findings, and strengthen the resultant theoretical framework (Gubrium and Holstein, 2001; Weiss, 1998).

Finally, Patton (1990) acknowledges that key actors are present in most programs, and if their names are frequently brought up - with respect to their value, their importance should not be neglected and should be sought out. During the data collection phase several participants, without prompt, mentioned one another with respect to their use of technology. For example in his first interview Charlie acknowledged the work of both Bill and Ronnie:

> …but I think we're still on the phase where you've got the early adopters and that. And I also think about myself, Bill you know, Ronnie…Do you know there's a stack of guys who are really comfortable in tech. And whenever they look at the

> platforms and the different ways that they go about it, people just look at us as techy geeks. They'll look at it almost in hopelessness.
>
> Charlie - 8th February 2016

Hearing participants acknowledge one another, without them knowing who was involved in the study, reassured me that my sampling plan and strategies had been effective. I believe it had enabled me to recruit some of the main protagonists in this particular area within the PE profession in Scotland.

3.6 Data collection

When deciding which data collection approaches to use Willig (2008) claims: *'...there are no right or wrong methods'* (p.22). She suggests approaches should be selected based on their appropriateness and ability to garner information that will address the research question(s). Given the broad investigative stance employed in my study (see 1.6), I was concerned that relying on a single data collection method might result in an incomplete picture and understanding of the topic. Moreover, I understood that to address my research questions I required 'rich' data, namely information that would reveal the participants': *'...views, feelings, intentions and actions as well as the contexts and structures of their lives'* (Charmaz, 2006, p.14).

Warren (2001) distinguishes between qualitative methods that focus on understanding the context and setting which participants inhabit, and how it directly and indirectly impacts them - that is ethnographic approaches such as observation and field journals. Whereas, other approaches are concerned with establishing common themes between groups of participants - such as qualitative interviews. Moreover, Warren (2001) suggests that depending on the focus of a study, researchers tend to select one method

over the other. Given the nature and purpose of my study, I believed it was important to gather a dataset that would provide both, that is, afford comparability between participants, as well as portraying the different contexts within which they practiced. Another determining factor concerned the time and resources available for gathering the data, as well as the subsequent analysis of it (Kvale, 2007; Johnson, 2001). A timeframe between the spring and summer terms - February to May 2016, was planned for data collection. Therefore, I had to consider which approaches would allow me to collect the most meaningful data during this time. As this was my first time undertaking a study of this nature I also had to take into account my knowledge and understanding of the different data collection approaches, as well as my experiences using them.

3.6.1 Interviews

Given the investigative span of my study, the use of in-depth, qualitative interviewing was considered to be an appropriate method for collecting data on several fronts. Firstly, it would allow me to *'...achieve both breadth of coverage across key issues, and depth of coverage within each'* (Legard *et al*. 2003 p.148). Secondly, it would permit me to gather deep-seated information. That is knowledge that has become entrenched, subconscious and often not articulated by the participants on matters ranging from their lived experiences, professional ideologies, through to their cultural perspectives (Johnson, 2001). A third point concerns the temporal range of interviews, with Warren (2001) recognising the biographical nature of the method which would allow me to delve not only into my participants past, but also consider their future practices and ideas concerning technology.

Semi-structured interviews

The decision to use semi-structured interviews, an approach that sits somewhere between open-ended and more formally structured methods (May, 2001), was taken after considering the benefits and shortcomings of each form. A central feature of semi-structured interviewing is that it combines organisation with flexibility (Legard et *al.* 2003). The degree of structure afforded would allow comparisons to be drawn between participants (Bernard, 2013; Holstein, and Gubrium, 2004; Johnson and Weller, 2001), though Kvale (2007) argues that highly structured approaches to interviewing also allow such associations to be made. However, it was decided that a more structured approach would be too restrictive, and might result in a data set that covers the breadth of the topic, but lacks necessary depth. On the other hand open-ended interviews might provide the rich, thick data, that Charmaz (2006) maintains is vital in grounded theory research. However, the lack of standardisation when using an open-ended approach would make comparison of participants' accounts challenging, with concerns over the validity of any resultant conclusions (Johnson and Weller, 2001). Though, the flexibility inherent in semi-structured interviewing affords a degree of leeway: *'...allowing the interviewee the space to redefine the topic under investigation and thus generate novel insights for the researcher'* (Willig, 2008 p.24). Advocates of constructivist methodologies perceive an interview as a site, and an event, for meaning making, in so much as new knowledge may be created from the dialogue and interaction between the interviewer and the participant (Holstein and Gubrium, 2004; Kvale, 2007; Legard *et al*. 2003). As Holstein and Gubrium (2004) state:

> Meaning is not merely elicited by apt questioning, nor simply transported through respondent replies, it is actively and

> communicatively assembled in the interview encounter, Respondents are not so much repositories of knowledge - treasuries of information awaiting excavation - as they are constructors of knowledge in association with interviewers. Interviews are collaborative accomplishments, involving participants in meaning - making work in the process.
>
> Holstein and Gubrium (2004 p.142)

Consequently, semi-structured interviews are more consistent with the constructivist underpinnings of my study, and provide scope for me to respond to the emphases of the participants, namely adapting the order of questions, asking new and unplanned questions, as well as re-framing questions using their language (Bryman, 2008). Being alert to the language and terms used by the participants, and seeking clarification on what is meant, is important in grounded theory, in order to capture the experiences of the participants and consequently the respective interpretations and meanings that they have developed (Charmaz, 2006).

3.6.2 Developing the interview guide

The first stage involved identifying broad themes to be explored in the preliminary interviews. This initial exercise led to a series of questions being developed around those themes in order to elicit the information sought. Following Bryman's (2008) advice the ordering of the questions was also given due consideration. A logical ordering would allow smooth transitions between the questions, and give the interview a more conversational feel. Though, ordering would be flexible and permit questions to be asked in an order that suited the participant, as well as allowing scope to respond accordingly to unexpected issues raised by participants (Legard *et al.* 2003).

This preparatory stage of the interview process resulted in a draft of what Bryman (2008) refers to as an interview guide being developed. It was considered a guide, as

opposed to a script or schedule, as the wording of the questions on the guide was kept to a minimum (see Appendix C). For example, sometimes only a heading was provided - acting as a prompt or aide memoire for what was to be covered, as opposed to a formal question (David and Sutton, 2011). The themes and prompts would therefore be easier to memorize, as I would not have to recall exact wording of specific questions during the interview (Cresswell, 2013). Thus, I would not have to refer to the guide throughout the interviews, and be able to maintain a necessary flow to the discussions. Finally, a guide, instead of a script, would also allow the reframing of questions and themes during the course of the interview - in order to make them more relevant to the participant and the situation (Willig, 2008). For example, this might involve adopting specific phrases and terms used by the participants, as well as drawing on observations from the setting and environment in which the interview is taking place.

3.6.3 Piloting

Guided by the advice of David and Sutton (2011) and Weiss (1998), a provisional interview guide was shown to my doctoral supervisors, who have a background and expertise in the field being investigated, as well as qualitative research. Their feedback led to a series of revisions, namely rewording, addition and omission of prompts, as well as re-ordering of themes.

The next stage of the process involved conducting a pilot interview using the revised guide (David and Sutton, 2011; Weiss, 1998). Given my limited experience in carrying out semi-structured interviews, a *'live'* practice was undertaken in order to develop my skills, as well as to become confident using the guide (Bernard, 2013; Robson, 2011). Given the number of participants recruited it was important not to forego any of them at the piloting stage, however, it is important for pilot interviewees to display some

characteristics and experiences of actual informants (Weiss, 1998). I needed to experience using my interview guide under low-risk conditions, and not at the expense of a failed interview (Weiss, 1998). This would also provide another opportunity to get post interview feedback on the guide, as well as my performance as an interviewer (David and Sutton, 2011; Robson, 2011). On this basis a colleague, who was an experienced practitioner, qualitative researcher and user of technology within their teaching was interviewed. Based on interviewee feedback, as well as my own reflections, further refinements were made to the guide, namely the reduction in the number of themes covered. Although it is recommended that a number of pilot interviews are carried out prior to entering the field (David and Sutton, 2011; Weiss, 1998), time was a determining factor and no further pilot interviews were undertaken. Upon completion of the pilot phase I was confident that my interview guide was fit for purpose - it was functional to use and effective in gathering the information I needed (see Appendix C). Furthermore, having undertaken the piloting process I felt more assured in my abilities and craft as an interviewer.

3.6.4 Pre-interview

David and Sutton (2001) recognise that any interview is bracketed by what happens before and after, and should be considered part of the process in establishing trust and a rapport with participants. A protocol was devised for contacting participants - a standardised email with initial arrangements sent out in advance of the interview. As well as requesting consent and general background information (see Appendix A), this communication provided an opportunity to clarify the aims and objectives of the study. Although it is suggested that informed consent and background information could be obtained during the interview (Bryman, 2008; Legard *et al.* 2003), securing this in

advance would allow me more time during the interview to explore the themes set out in the guide.

Conducting in-depth interviews is both intense and demanding (Bryman, 2008; Cresswell, 2013). Given the nature of semi-structured interviewing it is important to remain alert and responsive to not only what is said, but also when it is being said, the manner in which it is said, as well as what is not said (Bryman, 2008). When interviewing I would endeavour to use this information to re-frame questions and explore any novel insights that emerged. All interviews were to be conducted face to face. Thus, I would also need to be attentive to participants' implicit behaviours and non-verbal cues, which Robson (2011) acknowledges may endorse their verbal responses or even reverse their meaning. Given the intention to carry out the interviews in person, the site of the interview was also given due consideration.

When scheduling the interviews I allowed the participants to set a day and time suitable for them, a simple strategy that Mruck and Mey (2007) acknowledge is part of developing a non-hierarchical relationship with informants. Also, given my interpretivist position, and the emphasis this places on gaining an inside perspective, it was important to access, observe and experience aspects of the participants' departments and schools. Although this would not allow me to replicate their views, I realised it might assist in understanding how their meaning and actions are constructed and influenced by the wider, as well as immediate contexts in which they practiced (Charmaz, 2001; Clarke, 2005). Charmaz (2006) recognises that acquiring such a vantage point is beneficial as: *'seeing research participants' lives from the inside often gives a researcher unobtainable views'* (p.14). Finally, given that some themes in the

interview guide address more personal matters, it was important that the site and setting of the interview was one my participants felt comfortable and secure in (David and Sutton, 2011). I believed them being in their own school, in their own department, would provide such an environment. All participants agreed to my request to conduct the interviews at their schools.

3.6.5 Conducting the interview

Presentation

Bernard (2013) acknowledges what you wear can set the tone for the interview, telling the participant much about yourself and what you expect. Following Bernard's (2013) recommendation that interviewers should dress depending on the venue and context, my outfit was similar each time - smart, casual sportswear. Committed to seeking an inside perspective, I believed it was important to replicate the attire normally worn in the setting I was entering. Moreover, doing so would enable me to fit in and be more readily accepted by my participants, and in turn create a situation where they felt the interview was akin to a professional conversation with a fellow practitioner or colleague, as opposed to a formal interview.

Pre-interview protocol

Similar to the protocol devised for communicating with the participants pre-interview, I developed, and followed, a set of procedures on the day of each interview. I realised it was important to have a degree of standardisation between how the interviews were conducted in order to address concerns over comparability, validity, and reliability of my data. On the day of interview I arrived at the school in advance of the time arranged, which gave time to observe and get a sense of the schools locale. Furthermore, each

time I entered the school premises and building ahead of the agreed meet time in order to gain some perspective of the environment in which the teachers worked. Also, this opportunity might allow me to observe something that I could draw attention to in the interview, as was the case in Mick's follow up interview:

> I arrived at the school before the arranged time, which appeared to be as one period finished and the next started. I waited in the reception area/school atrium. The reception faces out into a huge open plan area that appears to be a social area/dining area on two levels. All the school departments seem to branch off of this central area. I waited a few mins. for Mick to arrive which gave me the opportunity to look around. I had noticed a plasma screen above the reception area last time I was here. However, today I noticed another plasma screen at the reception area. Both were not displaying anything and didn't appear to be switched on. Furthermore, looking around the atrium I counted a further 5 plasma screens! I sensed there were probably more that I couldn't see given my position. Some of the screens were displaying information, some weren't. I was surprised by the number of plasma's in this one area. A significant investment on the schools part! This surprised me given what Mick had said in our previous interview i.e. that the school did not really promote ICT that much, or at least that was his feeling. I wondered what all the plasma's were for and enquired with Mick when he arrived. He said he sometimes used them for displaying results/achievements etc. I also noticed some very large speakers in the atrium, one of which was beside where I was stood. I assumed they were part of the school's PA system. Again it appeared to be modern, and I imagine quite expensive.
>
> Field Journal: 20th May 2016

The interview is considered by some to commence *'...the moment the researcher arrives on the participant's doorstep'* (Legard *et al.* 2003 p.146). Early dialogue with participants, not necessarily focussed on the topic of the study, is vital for establishing a relationship (Legard *et al.* 2003). All meetings with participants began with an

informal discussion, often subject-related, to establish empathy, rapport and demonstrate awareness of their context. On some occasions this informal discussion was related to my study, based on a prior observation that I had made. For example, the discussion between myself and Mick that focussed on the plasma screens in the schools main reception area (see previous excerpt from my field journal).

The site of the interview, within the school, was at the discretion of the participants. On each occasion a classroom, or dedicated meeting room had been arranged. Furthermore, there were often details within those settings that were helpful in developing an appreciation of the context in which the participants practiced. Also, observations from the immediate environment in which the interview took place were sometimes used within the context of the interview, as typified by the following field journal extract:

> The interview took place in what appeared to be a PE classroom located off the PE corridor on the ground floor of the building…Two things immediately caught my eye as I entered the room - the IWB at the front of the classroom, as well as a portable projector that sat on a trolley in the front corner of the room. It was a particularly large (and rather dated) projector! We discussed Keith's use of the projector during the interview...
>
> Field Journal: 24th February 2016

Establishing my credentials

All participants in the study were professional people recognised by their peers for their use of technology in PE. In this sense they shared some of the characteristics that Bernard (2013) and Kvale (2007) refer to when discussing elite interviewees, namely being recognised by their community for their knowledge and proficiency in a

particular skill or area. However, I also felt it was important during the interviews to establish my own credentials by demonstrating, when appropriate, that I was informed and competent in relation to the use of technology in PE. This might help foster respect and trust with the participants, which I hoped would make them more comfortable and confident about speaking about their experiences, thoughts and feelings in relation to the topic. I also tried to achieve this by asking relevant, meaningful questions (Legard *et al.* 2003), sometimes using technical language exclusive to the area of study (Kvale, 2007). Additionally, I would employ what Johnson (2001) refers to as *'strict reciprocity'*, namely sharing my own views, reflections and feelings on particular matters. Despite claims that interviews are not platforms where researchers own views should be raised (Robson, 2011), the more in-depth form of interviewing employed in this instance is acknowledged as being different and requires more involvement and self-disclosure by the interviewer (Johnson, 2001). However, in doing so I was mindful of my position as an interviewer and the power asymmetry that would exist between me and the subjects (Kvale, 2007). Also, I understood the interview was not a forum for me to display how much I knew about the subject area (Legard *et al.* 2003). Nor was it a situation where I should consciously bias or exercise control over the participants (Bernard, 2013). A challenge during the interviews was to demonstrate my status as a member of the participants' community, that is, to be perceived as a practitioner who is also well-informed and proficient with the use of technology in PE. Though, not to a point where my status would impact adversely on the situation and act as a barrier that might influence what information is disclosed, or not, by participants (David and Sutton, 2011; Johnson, 2001).

Addressing prior assumptions

I understood the need to be conscious of my own assumptions concerning technology use in PE during the interviews, in particular how they might cause me to take for granted participants' responses. To address such concerns, as well as matters relating to my perceived status with the interviewee, I would occasionally express ignorance to points raised, and probe with interest for further clarification and detail (Johnson and Weller, 2001). This might involve me repeating a phrase or term used by the participants, for example: *'So you mentioned "ease of access", what do you mean by that?'* (Interview with Keith - 24th February 2016 p.1), or asking them to provide an example to illustrate what they meant, such as: *'...you talked about pupils being motivated by it* [technology]…*Could you give me an example?...'* (Interview with Bill - 26th February 2016 p.3). This notion of being a naïve interviewer would be used not only to develop an understanding of unexpected ideas that arose in the interview (Kvale, 2007), but also when participants discussed ideas I was familiar with, and held prior assumptions about. Therefore, not taking for granted what I thought I already knew (Willig, 2008).

Duration

Interviewing can be time consuming and make excessive demands on participants' time (Robson, 2011). From the outset I specified that participation would involve two interviews, each lasting approximately one hour. A greater involvement on the participants' part might have resulted in a reluctance to take part in the study (Robson, 2011). It is suggested that between 40 minutes and two hours is a reasonable length of time for an interview. Interviews in excess of this are questioned in terms of the interviewer and interviewee's ability to maintain their levels of concentration (Legard

et al. 2003; Willig, 2013). Although the majority of the interviews lasted for the estimated 60 minutes, several lasted much longer. Three participants, namely Bill, Brian and Charlie, were more than willing, and able, to discuss their experiences in detail, and at length. Although I had not anticipated the interviews running over by as much as they did, this issue is not uncommon when interviewing (Robson, 2011). With those participants that ran over, I sensed they rarely got the opportunity to talk about their experiences with technology in such a way, and with someone who was interested and sensitive to their views. Furthermore, many of the participants appeared to enjoy the opportunity, being able to share their experiences with a view to helping others, as well as furthering their own knowledge and practices, as illustrated by Ronnie's post interview email:

> It was a pleasure and really made me think about what I can do next to further develop the use of technology to enhance pupil learning at [Name of School Removed].
>
> Email received on 18th March 2016

I was alert to the length of time being taken during the interviews, and that it was good practice, and a professional responsibility, to stay within the time specified (Cresswell, 2013; David and Sutton, 2011). During the interviews that ran over I endeavoured to address the issue by increasing the pace of my questions and prompts when I realised that we were likely to exceed the prearranged 60 minutes. I also sought approval from participants to continue beyond the time agreed (Legard *et al.* 2003).

Probing and listening

Successful interviewing is often dependent on the ability of the interviewer to do two things effectively: probe the interviewee (Bernard, 2013; Robson, 2011); and listen

carefully - in particular be alert to the information disclosed, or not, as well as the manner in which it is divulged (Bryman, 2008; Weiss, 1998). During the early interviews I tried to address both. I made an effort to ensure the interviewee's were aware I was listening, and interested in what they had to say by maintaining eye contact, use of bodily gestures, as well as varying my facial expressions in response to their answers (Legard *et al.* 2003; Robson, 2011). This was also reflected in my verbal behaviour, where I would recall terminology and phrases used by the interviewee's, and incorporate them into the questions posed (Willig, 2008). With regards probing the interviewee's to elicit further information, I made an effort to use a variety of prompts suggested by Bernard (2013): using periods of silence (silent probe); reiterating the interviewee's response (echo response); expressing agreement or approval (uh huh probe); and asking for further information (tell me more probe). However, by placing emphasis on listening actively, as well as recurrently probing for information, my behaviour in early interviews was at times too contrived, and on occasion probes were used when they were not required and vice versa.

Developing my craft

As the interviews progressed I became increasingly aware of the intricate nature of interviewing that Kvale (2007) alludes to - which the pilot had not prepared me for. For example, after reviewing the audio recordings of early interviews I found I was responding and following up on some information and cues, but missing others as a result of focussing too much on my own behaviours. However, the follow up interviews did provide the opportunity to revisit ideas that had not been explored adequately first time round, and thus gain the: *'...depth, detail and resonance...'* that I required (Charmaz, 2001 p.682). Also, having time between interviews afforded the

opportunity to reflect on my craft as an interviewer. This involved reviewing the audio recording prior to transcription, as well as alongside the interview once it had been transcribed. As Kvale (2007) claims interviewing is a skill learned through practice, with Robson (2011) suggesting elements such as the use of probes, is an art form that is difficult to convey to novice interviewers. However, as I progressed, particularly during the follow up interviews, I felt more competent and assured, and a result more instinctive in my ability to probe and listen actively.

Recording the interviews

All of the interviews were recorded using an Olympus WS-311M digital voice recorder, and transcribed post-interview. Participants were informed of this intention pre-interview, along with details about the documentation and storage of the recordings (see Appendix A). The decision to record each of the interviews was taken after considering the advantages and disadvantages for doing so. The presence of a recording device may be detrimental as it might perturb participants, making them self-conscious of what they are saying knowing their responses are being kept (Bryman, 2008; Willig, 2008). However, the permanency of the recording allowed me to focus on other factors during the interview such as the subject matter, my own behaviours, as well as those of the interviewee (Kvale, 2007; Robson, 2011). Given the estimated length of the interviews, note taking would not have been practical. Also, being able to vividly recall all the ideas and themes covered afterwards would have been challenging (Bernard, 2013), and taking notes would prevent me from devoting attention towards the interviewee, namely loss of eye contact, as well as disrupting the pace and flow of the interview (Legard *et al.* 2003). Consequently, this could impact my ability to establish rapport with participants (Willig, 2008). However, I was

mindful of Kvale's (2007) concerns with relying solely on audio recordings. In particular: *'The tape recording of the interview involves a first abstraction from the lived bodily presence of the conversing persons, with a loss of body language as postures and gestures'* (p.93). Thus, I tried to remain alert to participants' behaviours and gestures in response to the questions and probes during interviews (Bryman, 2008).

Finally, the recording equipment used, more specifically the microphone attachment, acted as a catalyst in several interviews, with participants enquiring about the model, cost and quality. This was perhaps unsurprising given the particular focus of my study, and my participants' interests in technology. Warren (2001) acknowledges the novelty factor associated with being recorded, and presence of equipment often provides a stimulus for informal exchanges between the interviewer and participant. In turn, this can help establish the context for the interview, as well as rapport between the interviewee and researcher - as was the case here.

3.6.6 Post-interview

All interviews were transcribed in full post interview. Transcribing is demanding in terms of the time and effort required to do it, and expensive if outsourced and completed by a third party (Bernard, 2013; Bryman, 2008; Cresswell, 2013). With limited time available the decision to outsource this task to a private transcription company ('Way with Words Ltd') was taken. There is an argument that doing your own transcription brings you closer to the data, with the time spent beneficial in gaining a: *'...a fine grained knowledge of your own data…to have a feel for the talk…'* (David and Sutton, 2011, p.129). Despite not doing the transcribing I took steps to remain close to my data by reviewing it as part of the transcription process, something

Bryman (2008) recommends in relation to the quality of interview recordings. Each audio file was reviewed prior to being sent away for transcription, and again afterwards when the recording and transcribed interviews were checked side by side for accuracy.

3.6.7 Following up

Checking and validating

On the basis that: *'…multiple sequential interviews form a stronger basis for creating a nuanced understanding…'* (Charmaz, 2001 p. 682), a follow up interview with each participant was arranged. The decision to conduct two interviews was determined by two key features of grounded theory - theoretical sampling and constant comparison. Charmaz (2006) suggests confidence in one's data, that is the certainty about the emergent themes and categories and how they relate to one another, is enhanced by returning to the field to re-interview participants. Though Charmaz (2006) emphasises the purpose of doing so is to further develop categories and theory, re-interviewing also provides an opportunity to verify and validate ideas through member checking - a decisive strategy in terms of addressing issues regarding the credibility of qualitative studies (Lincoln and Guba, 1985; Seale, 2002). Instead of having participants review their raw data for accuracy, as is often suggested (Cresswell, 2009; Punch, 2014), I presented them with tentative ideas that I had developed in my early analysis and interpretation of the data (See Appendix D). The participants had the opportunity to agree or disagree with how they were represented in the themes and ideas that were being developed - that is *'...their words match what they actually intended…'* (Shenton, 2004 p.68). For the credibility of my findings it was important participants were able to identify their experiences in the concepts and theoretical framework I was

constructing (Krefting, 1991). Nevertheless, despite support for such checks, concerns have been raised that they can lead to confusion and misunderstanding as opposed to confirmation. For example, upon reviewing transcripts and any emergent ideas participants may change their mind. This could be due to experiences post interview, or the interview itself may have initiated a period of reflection that resulted in them adopting a different position on such matters (Sandelowski, 1993). However, I welcomed possible changes as a result of member checking, seeing it is another opportunity to generate data. Moreover, it might provide further insight into the phenomenon being investigated (Silverman, 2006).

During follow up interviews a systematic approach was adopted in terms of member checking, with verification taking place within and between data sets. For example, early ideas emerging from a teacher's initial interview were revisited and discussed in the follow up interview with the same teacher. In addition, ideas emerging from the interviews with other participants were discussed between teachers to establish whether they held similar beliefs and understandings. Cresswell (2009) suggests that: *'the point is to gather information to fully develop or saturate the model…'* (p.89). Furthermore, he believes that carrying out a series of interviews, with the intention of not only checking emergent ideas, but further developing them, will lead to substantive and more credible grounded theories.

3.6.8 Field journal

The use of multiple, often diverse, forms of data help substantiate the findings of a study (Charmaz, 2006; Clarke and Friese, 2007), on this basis I decided to supplement the interview data with a field journal (See Appendix E). I was concerned that relying solely on one source may limit my grounded theory. Furthermore, the interviews might

not capture the wider, as well as the immediate, contextual information integral to Charmaz (2006) and Clarke's (2005) variants of grounded theory.

Capturing the context

Savin-Baden and Major (2013) states that notes taken in the field should not only record behaviours and events, but also portray the surroundings and other circumstantial information. Given the emphasis I was putting on the situation and contexts in which the teachers operated, I believed that a field journal would allow a more comprehensive picture to be developed. Furthermore, the observing and documenting of incidental, taken for granted features within the participants settings might assist me in identifying possible ideas to explore, as well as further confirming any emerging ideas (Charmaz, 2014). Lastly, when interviewing it is acknowledged that important information is often disclosed in conversations that take place when the tape recorder is switched off (Warren, 2001). The field journal would provide a place for documenting such information.

Field journal entries were completed both pre and post interview, and comprised three distinct sections: my observations and thoughts about the environment - for example *'where the interview took place'* (Bryman, 2008 p.444); the participant - for example *'Did the informant seem evasive or nervous'* (Bernard, 2013 p.196), as well as personal reflections on my performance as an interviewer (David and Sutton, 2011).

Prior to interviews I documented demographic information about each school, for example size of the school roll and location using the Scottish Government's national schools dataset (Scottish Government, 2015b). This was important in beginning to develop an appreciation of the context and conditions in which the teachers practiced.

Post interview I added to this section documenting any on-site observations, made before, during and after the interview.

Prior relationships

Creswell (2013) acknowledges when conducting interviews it is important to reflect on the relationship that exists between the interviewer and interviewee. Given that I had encountered most participants, in some capacity, prior to their involvement in my study, I considered it important to account for our relationship and reflect on how it might influence the research. On this basis I documented how I came to know each participant, providing information on the relationship I had with them. Post-interview I recorded information about their behaviour during the interview, as well as information about the context and timing off the interview which might have influenced their responses and actions - as illustrated in the following extract from Keith's follow up interview:

> I felt he was more relaxed than the last time we met. On the last occasion Keith had a cup fixture (football) arranged for the afternoon and I felt that this was a distraction during the last interview…I felt he was more forthcoming with his answers and keen/trying to think and expand his answers further this time.
>
> Field Journal - 18th May 2016

Important information is often revealed by participants in the informal discussions that take place immediately before and after recorded interviews. For example, participants may provide new ideas and support earlier or later claims (Legard *et al.* 2003; Warren, 2001). The field journal was used to document any such information. The following

excerpt illustrates such a discussion that took place with Faye in the school games-hall after her initial interview:

> Faye opened a cupboard that was set within the wall of the games-hall to reveal the hardware that worked the projector and cameras. Again there seemed to be quite a lot of it i.e. PC, screen, keyboard and various other boxes - amps, drives, apple TV, etc. I imagine the number of devices and buttons might be off putting to someone that is fearful of technology. When I enquired about who used it within the PE department Faye claimed she was the only one.
>
> Field Journal - 24th February 2016

Given my background and experience as a qualitative researcher the field journal was also a space to ruminate over and record thoughts on my performance before and after each interview. This was helpful in surfacing perceived strengths and weaknesses, and considering how I might maintain or address them in subsequent interviews.

Bernard (2013) and Kvale (2007) recommend field notes be taken immediately, however, opportunities for notetaking in the field were limited. Also, aware of reasons for not taking notes during interviews, I was concerned that I could miss information in the informal discussions that took place or fail to notice cues within the school setting if I did take notes on site. As a result I took notes of any such discussions or observations upon returning to my car immediately after the interviews. Those notes were later reviewed and written up as formal entries in my journal. Again there was a sense of immediacy to this process in order to address concerns over recall, with each journal entry normally completed in the 24 hours post interview.

'All is data'

Unwittingly my field journal became useful for documenting more than contextual information. During the interview process I realised that communication with participants was not restricted to the face to face dialogue that took place during the scheduled interviews. As a result of the protocols followed, there was regular email contact with participants before and after each interview to confirm arrangements, as well to thank them for their involvement. Consequently, some participants' responses were revealing and supported ideas and themes developed from my interview data. With Glaser's (2001) maxim that 'all is data' in mind, I decided to include any relevant electronic communication between myself and the participants in the journal.

Finally, the field journal was used systematically throughout the interview phase. As well as making new entries before and after each interview, I followed Johnson's (2001) advice and re-examined previous entries before each interview. Reconsidering earlier entries as preparation for new interviews was helpful in recapping ideas and issues that had emerged, as well as areas not addressed, in addition to reminding me about areas of my interview technique that required consideration, as illustrated in the following excerpt:

> Linda brought an iPad along with her to the interview, but I was aware that she didn't use it to demonstrate any apps etc. during the discussion. Perhaps I need to tee this up prior to the second follow up interview i.e. ask if it would be possible to see some of the apps/platforms that she uses?
>
> Field Journal - 3rd March 2016

3.7 Analysis

Consistent with earlier sections in this chapter an account of the strategies undertaken during my analysis and interpretation of the data is presented. The decision to do so in detail was influenced by Maxwell's (2013) concerns that discussion of data analysis in qualitative studies is often weak, with descriptive, oversimplified explanations of how data was interpreted being provided. Similar to previous sections, as well as describing and justifying the various strategies employed, illustrative examples and diagrams will be used to give a sense of how I conducted the analysis.

Grounded theory texts tend to divide procedures involved in data analysis into discrete sections or chapters (for example see Charmaz, 2006 and 2014,). This section will be organized differently with three key elements associated with data analysis in grounded theory, namely coding, constant comparison, and theoretical sampling, described and explained simultaneously. It is important to acknowledge that although distinct, these features are reliant on one another, and in practice used in conjunction with one another as opposed to being employed in a linear fashion. The discussion that follows attempts to capture elements of their concurrent use.

3.7.1 Reflexivity

Charmaz (2014) maintains that if: *'...social reality is multiple, processual, and constructed, then we must take the researchers position, privileges, perspective, and interactions into account…'* (p.13). Thus, the importance of critically reflecting on my own personal biography, and considering how it may impact on aspects of the research process was understood (Hesse-Biber, 2007). Furthermore, recognising reflexivity to be a: *'...process of recognition of the role of the researcher in co-producing psychological knowledge'* (Langdridge, 2007 p.59), I realised I had to be even more

self-aware, and frank about my own experiences and tacit assumptions when analyzing the data. A central tenet of data analysis in grounded theory is allowing theory to be developed from the information gathered, and to prevent imposing prior concepts and extant theories on the data (Kelle, 2007; Riessman, 2008). However, Strubing (2007) argues previous experiences are advantageous to the analysis process, and it is a matter of making proper use of them. Prior knowledge affords the researcher a sensitivity, allowing them to notice subtleties in data that those without such knowledge and experience might miss (O'Neill *et al*. 2007). It is suggested that familiarity with the field also allows more elaborate understandings to be acquired more quickly, as Clarke (2005) acknowledges: *'we do not need to invest time and energies to reinvent wheels'* (p.17). For example, during analysis of the initial interviews *time* was a recurring theme in the data. Furthermore, I was alert to the concept as a result of my prior engagement with the wider and PE specific literature (see Thomas and Stratton, 2006; Tearle and Katene, 2005, Weir and Connor, 2009). Though, *time* in this instance proved to be what Charmaz (2006) refers to as a *'sensitizing concept'* - in other words a start point for further examination and analysis. Indeed, the concept of *time* was developed, eventually becoming a key feature of the broader concept *weighted investment* (see Chapter 4). Lastly, despite the importance of reflexivity in qualitative research it is claimed that it is often dealt with in a superficial manner (Langdridge, 2007). In an attempt to formalize the process and keep my assumptions in the foreground of the study any such accounts were recorded in my field journal.

3.7.2 Coding

Guided by Charmaz's (2014) account of the coding process, three distinct phases were undertaken - an initial period of *'open'* coding, followed by a phase of *'focused'*

coding, ending with a period of *'theoretical'* coding. Over 19 hours of discussion across 17 separate interviews was gathered. In order to manage and organise the interview data NVivo 11 qualitative research software was used. As well as aiding the analysis process the package was useful in providing a detailed audit trail of what was carried out (Bringer *et al*. 2006).

3.7.3 Coding - *'open'*

'Open' coding involved labelling sections of data, in this case segments from the interview transcripts - a process that helped define, explain and condense the data, allowing particular sections to be categorized (Charmaz, 2014). Consistent with Charmaz's advice my initial coding focused on: *'...how people* [participants] *enact or respond to events, what meanings they hold, and how and why these actions and meanings evolved'* (p.113). For example, in terms of enacting or responding to events an early code *addressing problems* was used to categorize how the teachers overcame obstacles encountered when using technology. Furthermore, in relation to the meanings they held, a broad category labelled *reasons for use* was used to denote the value the teacher's attached to technology, and their motives for using it.

Constant comparative method

During early stages of coding I realized the importance of getting *'close'* to the interview data in order to make sense of the participants' views and actions (Barbour, 2014; Dey, 2007; Maxwell, 2013). It is claimed that it is this *'close work'* that enables researchers to get beneath the immediately obvious, allowing them to realise and interpret what is being inferred by participants (Charmaz, 2012 p.8). Employing another central tenet of grounded theory - the constant comparative method (Holton, 2007), ensured a sustained engagement and familiarity with my data (Charmaz, 2014).

Constant comparison involved me interacting with the data by continually shifting back and forth within individual transcripts, for example, considering incidents within a single teacher's interview. However, comparison also occurred between transcripts, for example, considering incidents between the two interviews with the same teacher, as well as comparing incidents between different teacher's interviews (Mruck and Mey, 2007). Thus, I was able to continually compare and contrast codes and incidents with one another (Kelle, 2007) - a process that was helpful in refining, as well as developing new codes. For example, *investment* was an *'open'* code that emerged early in the analysis and used to categorize the time and effort the teachers devoted to technology use. This code was further developed through constant comparison, with a distinction eventually being made, namely both a *formal* and *informal* investment by the teachers (see fig. 4 in Chapter 4). Barbour (2014) describes the process of constant comparison as an interrogation of the data. A cross-examination that is necessary to reveal recurring patterns, as well as exceptions and contradictions present in the data. Although the strategy was used from the outset of my analysis, its use became more pronounced in the latter stages of the coding process as the volume of data increased, and I looked to establish the themes that had been developed from early transcripts.

Systematic and cyclical

During this stage of analysis a cyclical process of coding was established whereby transcripts were coded in the same order that the interviews took place (see fig. 1). Codes accrued as each transcript was examined, with new codes being added in light of novel incidents and experiences occurring in the transcripts. Upon completion of the first cycle several new codes had been developed as a result of examining later transcripts, namely the number of categories had increased as the initial cycle

progressed. It was therefore important to re-examine the early scripts in light of the later codes that had emerged. For example, with regards the theme of *investment*, as later transcripts were analyzed and the sub-categories *formal* and *informal* investment were developed, it was important to re-examine and re-code the earlier transcripts in view of these new sub-codes.

Undertaking successive cycles of *'open'* coding led to new codes being developed, as well as older codes being refined. This occurred as a result of re-interpreting previously coded incidents and realizing there was more going on than initially assumed. This cyclical process continued until no new codes could be added. Although a protracted process, with the benefits not immediately apparent, this early analysis served to make the later stages of the coding process less problematic. In particular, the extended period of *'open'* coding enabled me to construct more robust and well developed categories in the *'focused'* coding phase that followed. Furthermore, the extensive preliminary work would allow the analysis and interpretation in subsequent stages of coding to proceed more quickly (Charmaz, 2012).

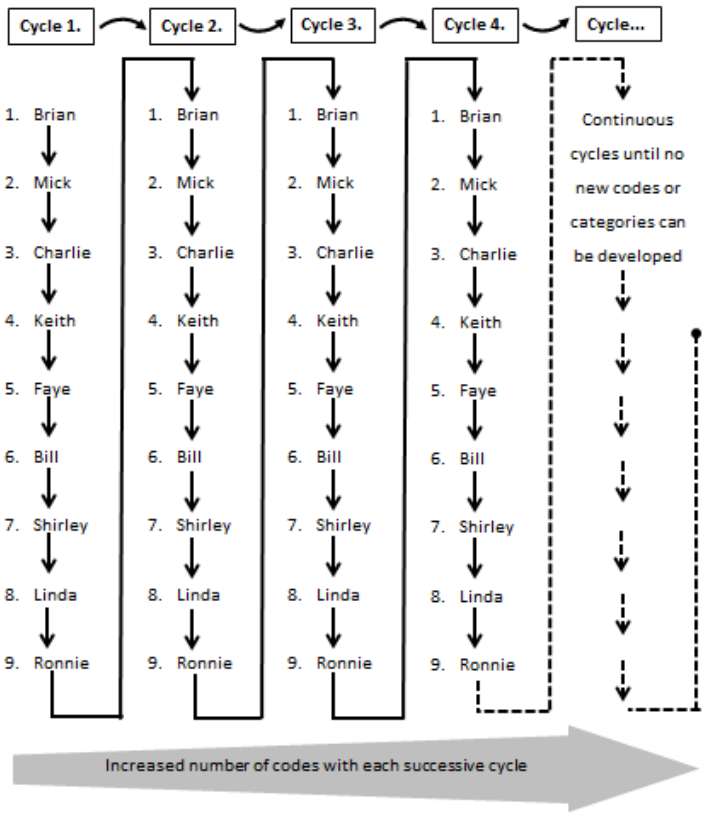


Figure 2: Systematic approach employed during the initial 'open' coding phase.

3.7.4 Coding - *'focused'*

'Focused' coding involves going back through data labelled in the previous phase in order to identify the most recurrent and significant codes (Charmaz, 2006). Acknowledging recurring codes was helpful in determining the key concepts that I would base my grounded theory on. The process was also necessary to establish the theoretical direction of subsequent analyses and data collection (Charmaz, 2014). For example, the *'open'* code *reasons for use* appeared significant with 249 incidents recorded after initial coding. Having established the most frequent labels, I was able to re-examine the transcripts and focus on the incidents categorized within those codes. The purpose now was to: *'...determine the adequacy and conceptual*

strength…' by developing and refining discrete criteria for each code (Charmaz, 2014 p.140). For example, with regards to the code *investment*, which became *formal* and *informal* during *'open'* coding, I was able to establish a variety of behaviours and roles adopted by the participants that indicated the extent of their investment. Moreover, I was also able to ascertain key features and characteristics that defined and determined the scope and boundaries of the categories (see fig. 3).

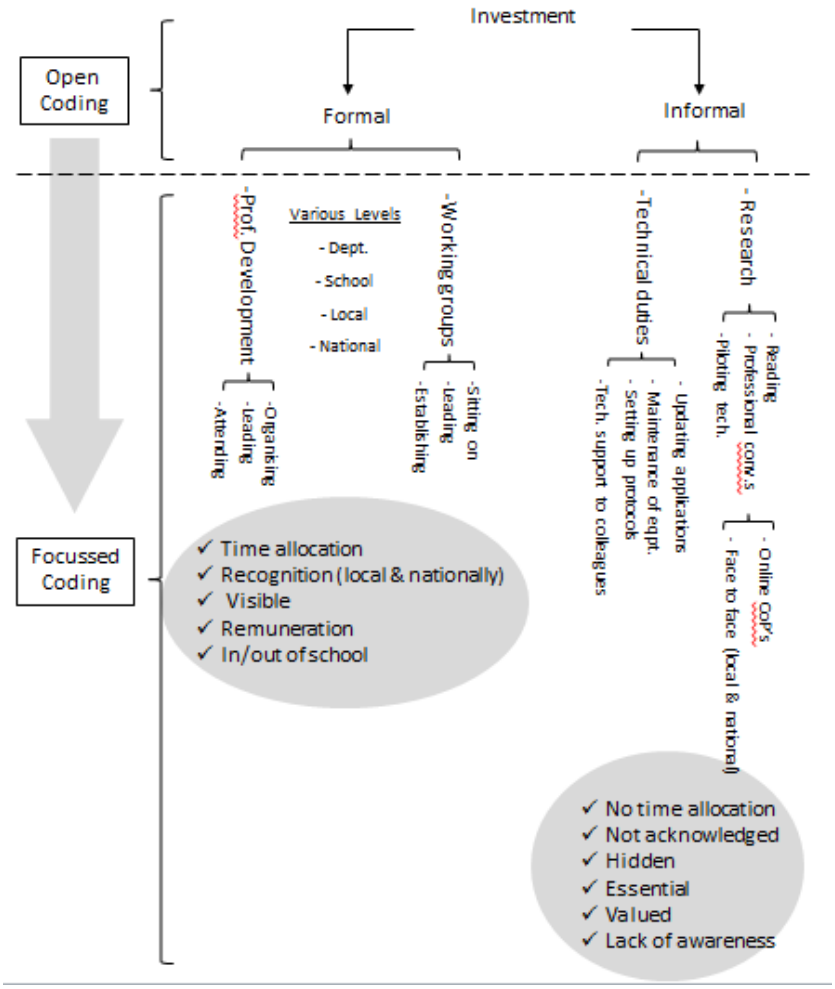


Figure 3.0: 'Investment' - from 'open' to 'focused' coding

During *'focused'* coding I continued to constantly compare my data, going to and fro within and between transcripts, checking and refining recurrent incidents and concepts

that were emerging (Charmaz, 2014). The process was cumulative with the properties and dimensions of codes becoming increasingly more elaborate (Holton, 2007). Thus, a more sophisticated appreciation of what was happening, and why, was developed (Charmaz, 2014). Furthermore, this led to greater insight and subsequently a further abstraction of my codes, as their common properties and features became more and more established.

Theoretical sampling

The process of data collection and analysis occur simultaneously in grounded theory research. Consequently, along with constant comparison I employed another key tenet of grounded theory - theoretical sampling. It was the concurrent use of those two strategies, referred to: *'...as the twin foundations of grounded theory'* (Holton, 2007, p.20), that allowed me to clarify and illuminate the codes assigned to incidents and ideas in my data.

The decision to conduct follow up interviews with participants was underpinned by the notion of theoretical sampling. Having established key concepts, as well as a preliminary framework from my analysis of the initial interviews, I was able to revisit these ideas in follow up interviews (see Appendix D). As such, in follow up interviews I was able to collect data that allowed me to stretch the properties of codes I had developed (Leigh-Star, 2007) by subjecting them to new settings (Dey, 2007), in turn advancing my theoretical framework (Stern, 2007). For example, an early idea emerged about the use of technology being advantageous for career advancement, especially with those participants that were early career teachers. In follow up interviews I was able to revisit and explore this idea further with those teachers, as

well as find out views of the others who had not disclosed information about such motives - as illustrated in the following excerpt from Bill's follow up:

> *Me: …there was one set of reasons, mostly personal reasons…a couple of probationers and people (teachers) in their first three years…talked about wanting to develop a skillset that would make them more employable, and that was a more personal reason to get into it…can you relate to that?*
>
> Bill: Absolutely, technology opened up certainly a lot of doors for me and I don't know if I saw it as a way of advancing my career, but I certainly did see it as a way of advancing me as a person. Just really it caught my imagination. A lot of it was to do with the learning and the teaching….I was already a principal teacher so it wasn't like I was trying to get on within the world of PE, but I did kind of see it as maybe a possibility of leading onto bigger and better things to do, of that whole advisory side of PE. So yes, I suppose there was some of that.
>
> Bill - 24th May 2016

Despite the emphasis in follow up interviews on expanding and refining the properties of my codes (Dey, 2007), there was also the prospect of confirming my interpretations of the data. More specifically, additional interviews would allow me to check that I had not misinterpreted or misrepresented the views and experiences of participants. A similar protocol to that used for coding the initial interviews was used in the analysis of the transcripts from the follow up interviews (see fig. 1). However, there was greater emphasis on *'focused'*, and *'theoretical'* coding during the later stages of the analysis process.

Memo-writing

Memo-writing was a useful way of keeping track of emergent ideas, as well as raising my codes to more abstract levels and into the conceptual categories that would be the basis of my theoretical framework. Memos were written from the outset of the analysis, though my early notes were descriptive, and frequently posed more questions of my data. However, Clarke (2005) highlights that a lack of answers early in analysis is normal, and questions are helpful in providing direction in subsequent analyses and interviews, as illustrated in this early memo:

> …time is not an issue according to Mick, but he appears to dedicate a lot of time both in and out of school looking up and researching new technologies i.e. apps/programs/hardware. Mick states *'If it takes time to set up, it takes time…'* when looking into and using new apps. He appears to be comfortable dedicating the time towards finding and setting up new apps, is this because he is aware of the impact they will have? Furthermore, he seems to get satisfaction from searching and finding and trialling new apps (is this something he finds enjoyable?). Lastly, he appears to have voluntarily taken on various technology related roles in the dept./school that collectively take up considerable time. Is he aware of the time he is devoting? Furthermore, what motivates him to put in the time with tech.?
>
> Field Journal - 5th February 2016

In the advanced stages of my analysis my memo writing became more abstract as ideas were further conceptualized and I began to position them within my theoretical framework (Holton, 2007). For example, ideas about *time* noted in the previous memo became a recurrent theme in subsequent interviews with all participants. Furthermore, this early idea was developed and elaborated upon, through subsequent memo's, to become a core concept within the final framework, namely *weighted investment*. Charmaz (2006) and Clarke and Friese (2007) acknowledge the synthesis of data as an

interactive process, with the researcher's interpretation and reordering of the incidents and ideas key to developing new insights. As my codes were developed and further conceptualised, their status was elevated, with their place and positioning within my theoretical framework becoming more and more assured (Hood, 2007; Kelle, 2007).

3.7.5 Coding - *'theoretical'*

'Theoretical' coding is the final phase of the data analysis process and involves providing form to previously established *'focused'* codes (Charmaz, 2014). Additionally *'theoretical'* coding aims to integrate *'focused'* codes into a more coherent framework. This is achieved by scrutinizing those codes further, with an emphasis on understanding how they relate to one another (Charmaz, 2006). During this final phase I was able to distinguish links between *weighted investment* and other concepts that had emerged, such as *lack of support from senior managers* (see fig. 3*)*. Moreover, in developing links between those concepts I was then able to explain and account for the effort and time the teachers were investing in technology.

Prompted by Clarke and Friese's (2007) advice, I used diagramming during the *'theoretical'* coding phase to illustrate how *'focused'* codes relate to one another (see fig. 3). The strategy also proved invaluable in allowing me to visualize relationships between my codes, as well as *'...the relative power, scope and direction…'* of those concepts (Charmaz, 2014 p.218). Additionally, diagramming was helpful in reporting my findings as I was able to visually represent my conceptual framework, or grounded theory (see figs. 4-6 in Chapters 4-6).

Finally, grounded theory leads to an abstract interpretation of data which is suggestive and somewhat inconclusive (Charmaz, 2006). Moreover, it provides one depiction,

and not necessarily an exact picture, of the phenomenon being investigated (Schwandt, 1994). However, by following Charmaz (2006) and Clarke's (2005) guidelines the reliability and validity of my findings would be enhanced. Furthermore, the conceptual framework that resulted would be robust and in-accordance with my interpretative position. By respecting the principles of: simultaneous data collection and analysis; memo-writing; returning to the field to gather subsequent data to substantiate and elaborate upon emergent ideas; systematic open, focussed, and theoretical coding; constant comparative analysis to locate similarities and differences within and between the data, I believe I was able to develop a grounded theory that was credible, authentic, and trustworthy (Charmaz, 2006; Cresswell, 2009).

Chapter 4 Describing the teachers' *weighted investment* in technology

4.1 Overview

The purpose of this chapter is to address the initial aim of the investigation presented at the end of Chapter 2 (see p.48), namely to develop a broader understanding of PE teachers in Scotland's everyday habits and associated practices with technology that extends beyond the current and 'best' practices frequently depicted in the research literature. In realising this aim, the discussion that follows describes in detail a major theme developed from these lead users' narratives, namely their *weighted investment* in technology (see fig. 4). This broad concept not only encompasses these teachers wider involvements with technology - as opposed to specific practices with particular devices or applications, but also the manner in which they engaged with it, especially the time and effort they devoted to technology.

4.2 Major themes

4.2.1 Weighted investment

The term *weighted investment* encapsulates two key features from the interview data. First, the term acknowledges the time and effort reported by participants in their engagement with technology. Given the nature of the data this was difficult to quantify precisely, but all teachers in the study reported devoting considerable amounts of time and energy to technology related matters. Second, the term also captures the notion that the teachers were predisposed towards technology, devoting more time and energy towards it than other aspects of their role. Reasons why these participants were inclined to invest time and effort in technology will be examined in subsequent chapters (see Chapters 5 and 6).

4.2.2 *Formal* and *informal* investment

The teachers engaged with technology in both *formal* and *informal* ways (see fig. 4), with the range of practices undertaken providing some indication of the scale and scope of their *weighted investment*. Before distinguishing between the various practices it is important to acknowledge they are not discrete from one another, and that participants did not report them in this way. The associated *formal* and *informal* habits and activities undertaken by the teachers were often interrelated, and I will discuss and illustrate these interrelations where possible.

Formal investment

Formal investment encompassed a set of recognisable habits and behaviours reported by these teachers' in relation to technology, namely engaging in professional learning, leading professional learning, as well as being involved with related working groups (see fig. 4). Those practices were considered *formal* as they involved undertaking duties and responsibilities for which the teachers' might receive direct, or in-direct, professional recognition or recompense from their school, local authority or governing body - such as the General Teaching Council for Scotland (GTCS). For example, attending a professional learning event delivered by an external provider, or being a member of a school working group on matters to do with technology could be considered *formal* as the teacher's involvement or role could be documented as part of a professional learning portfolio or profile, such as the GTCS professional update scheme[5] for teacher re-accreditation.

[5] Teachers in Scotland are required to undertake professional learning. Furthermore, they are expected to evaluate any learning against current teaching standards, and maintain a record of any training undertaken using their online GTCS' profile. See: http://www.gtcs.org.uk/professional-update/professional-update.aspx

Informal investment

Similar to *formal* investment, *informal* investment included a range of habits and behaviours undertaken by these teachers' with respect to technology, such as carrying out technical duties, engaging in impromptu practitioner dialogue and inquiry, as well as assuming campaigning duties (see fig. 4). Those practices were considered *informal* as they involved undertaking roles and responsibilities for which the teacher's might not receive direct, or in-direct, professional recognition or reward from their school, local authority or accrediting body. Moreover, *informal* practices would not be eligible for inclusion on a professional learning record or portfolio in the same way as *formal* behaviours would be. For example, the job of updating software on departmental tablet computers is a necessary task, yet, no credit or time was allotted for carrying out such duties.

The following section will examine discrete *formal* practices undertaken by these teachers, namely their involvement in formal professional learning for their own development, as well as for the benefit of colleagues. Also, participants involvement at a strategic level, as part of school and authority working groups focused on technology use will be considered (see fig. 4). The latter sections of the chapter will examine the teachers' *informal* practices with technology, namely undertaking technical duties, engaging in impromptu practitioner dialogue and inquiry on such matters, as well as assuming unofficial roles such as a technology champion and campaigner in and beyond their respective schools (see fig. 4).

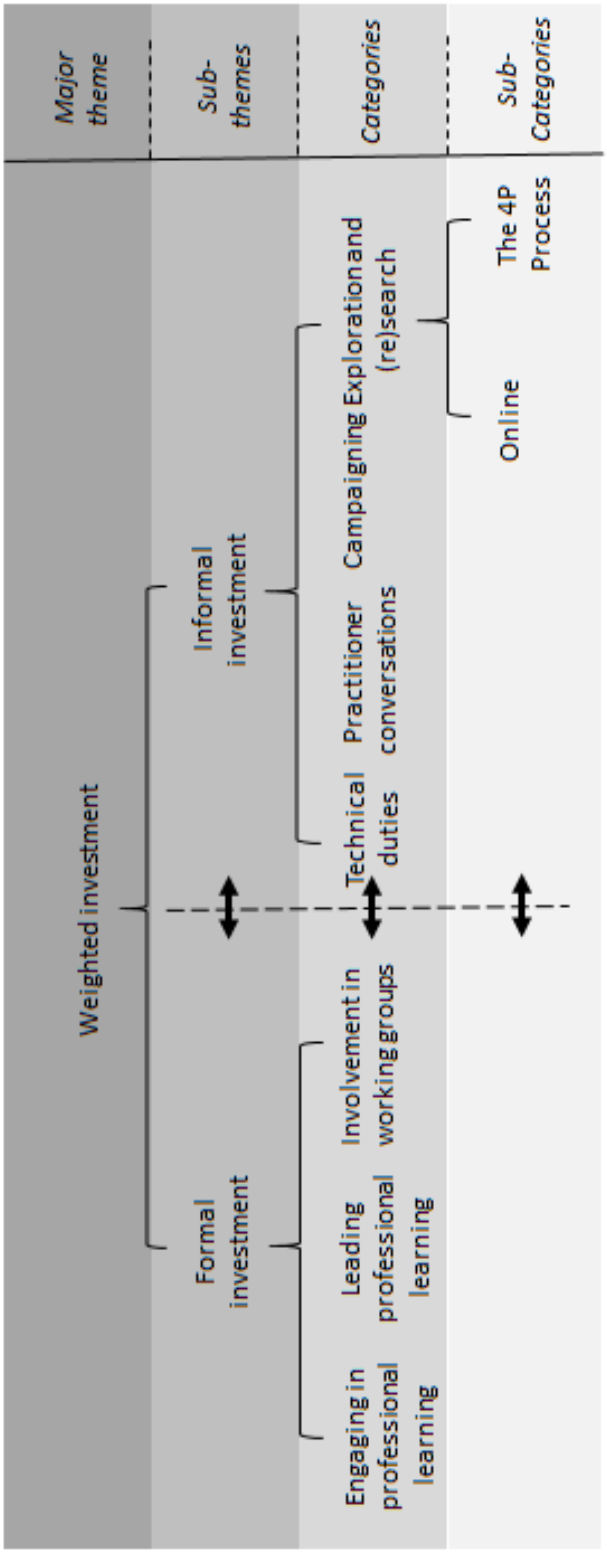


Figure 4: Weighted investment: Participants' reported habits and practices with technology

4.3 Formal investment

4.3.1 Engaging in professional learning

A willingness and commitment towards their own professional development, with respect to the use of technology, was apparent in all participants' accounts. The teachers reported seeking out formal learning opportunities of their own volition, and that their engagement with those opportunities was ongoing. A picture of the teachers' as enthusiastic, self-motivated learners was exemplified by Linda when she discussed her motivations for undertaking professional learning:

> …Let's see if I can upskill myself, let's see if I can make my lessons any better or help my kids out or help the school out as well…
>
> …I think I very much wanted to learn more about it [technology]. I had this opportunity, wanted to upskill myself, so I opted in to these courses that were going on…
>
> Linda - 3rd March 2016

The professional learning carried out by the teachers ranged from generic courses on the use of particular software or hardware, to more subject related workshops and events. Moreover, the training was undertaken in a variety of ways. For example, Bill and Mick indicated that they engaged in online instruction. For Bill, this involved a period of generic training leading to formal accreditation, namely him becoming a certified Google Trainer. This allowed Bill to develop his own knowledge and skills using the Google platform, as well as support colleagues use of it (Bill - 24th May 2016). Mick's online training was more specific to PE, but not endorsed in the same

manner: *'...and I've done my web seminars with* [Name Removed] *the PE Geek*[6] *and, you know, a few of his things'* (Mick - 20th May 2016).

The majority of professional learning undertaken by these teachers involved more traditional formats, such as one-off events or a series of face to face workshops. Participants indicated they had attended such training at local and national level, for example, in-house workshops arranged as part of their school's in-service programme, local community events organised by their educational authorities, as well as national events run by governing bodies and associations - such as Education Scotland and SATPE. This was in addition to sessions offered by private providers, such as the aforementioned PE Geek. The PE Geek figured prominently in several teachers' accounts of their own professional learning, with many indicating their attendance at a workshop he had delivered. It emerged that one participant, Brian, had been central to organising the event, the first of its kind in Scotland, with the workshop taking place at his school. The appeal of the PE Geek event and the learning resources he provided was typified by Shirley's comments, when she signalled her intent to attend a future PE Geek event:

> …In terms of CPD, my colleague he went to PE Geeks last year…I couldn't go, which I was quite gutted about. But I think he's coming back...so I'm kind of hoping to go to that…
>
> Shirley - 29th February 2016

[6] The PE Geek is a physical education teacher from Victoria, Australia. This practitioner has a significant online presence and profile amongst the PE community as a result of his website, blog, and workshops that focus on emerging technologies and their role within the teaching and learning of physical education. As well as presenting nationally and internationally on this area, he runs a mobile development company which builds apps for educational purposes.

4.3.2 Leading professional learning

Given the criteria in my sampling plan (see 3.5), I understood that several participants, namely Bill, Brian, Charlie, Linda, Mick and Ronnie, had all been involved in either or both the organisation and delivery of professional learning in relation to technology use in PE. Though it transpired only one teacher, Brian, was obliged to do so as part of his present role and remit[7]. However, Brian's involvements in professional learning were not restricted to his school. He was also involved in the organisation and delivery of professional learning at local authority level, on those occasions of his own volition:

> …I've run CPDs here every year for five, six years. I've done whole school CPDs with Edmodo and other, other apps and software, and across the council as well.
>
> Brian - 1st February 2016

The long-standing, ongoing commitment reported by participants with respect to their own professional development (see 4.3.1), appeared to also extend to organising and leading professional learning for colleagues. The notion of time and effort being invested over a long-term in this particular area was evident in Brian's previous comments, as well as those of Bill and Charlie - the two more experienced teachers in the study. Charlie, like Brian, appreciated the extent of his involvement and was conscious that he was: *'...always kind of the one presenting on it* [technology in PE]*...'* (8th February 2016), before elaborating:

> Every time there's an Ed. Scot. event, Charlie, can you present? So you're signed up to go to listen to other people

[7] Alongside his role as Curriculum Leader for Health and Well-Being at the school, Brian had wider responsibilities in a promoted role overseeing teaching and learning matters on the school's 1 to 1 iPad programme: 'My job is to educate the pupils, educate the staff, [*provide*] support…' (Brian - 1st of February 2016).

> and they're going actually Charlie big man, can you present on this, this, this, and this? Aye, okay.
>
> Charlie - 8th February 2016

Bill's commitment was similar, and like Brian and Charlie appeared to be aware of the amount of time and effort he had invested: *'...I have obviously delivered quite a bit of CPD myself...'* (24th May 2016). Furthermore, he raised concerns that: *'...folk must be getting sick of seeing my face…',* as a result of him regularly presenting at such events.

An ongoing commitment to leading professional learning was also apparent in some of the early career teachers' narratives, most notably Linda, Mick and Ronnie. This was illustrated by Mick who maintained: *'In both my previous departments I did a CPD within the first month and throughout the rest of the year'* (5th February 2016), before indicating he was due to deliver a similar workshop at his current school: *'I'm doing a CPD hopefully in the February week for the department here…'* (Mick - 5th February 2016).

The scale of the teachers' involvement in leading professional learning emerged as they recounted the different events they delivered at. It transpired their involvement was not limited to their own departments or schools, extending to those within their immediate locale, and wider still to schools within their local authority. In some instances, their commitment extended further, with some teachers delivering at national events. In all those cases it seemed their involvement in professional learning had followed a similar trajectory, with the teachers' involvement increasing rapidly and perpetually (see fig. 4.1).

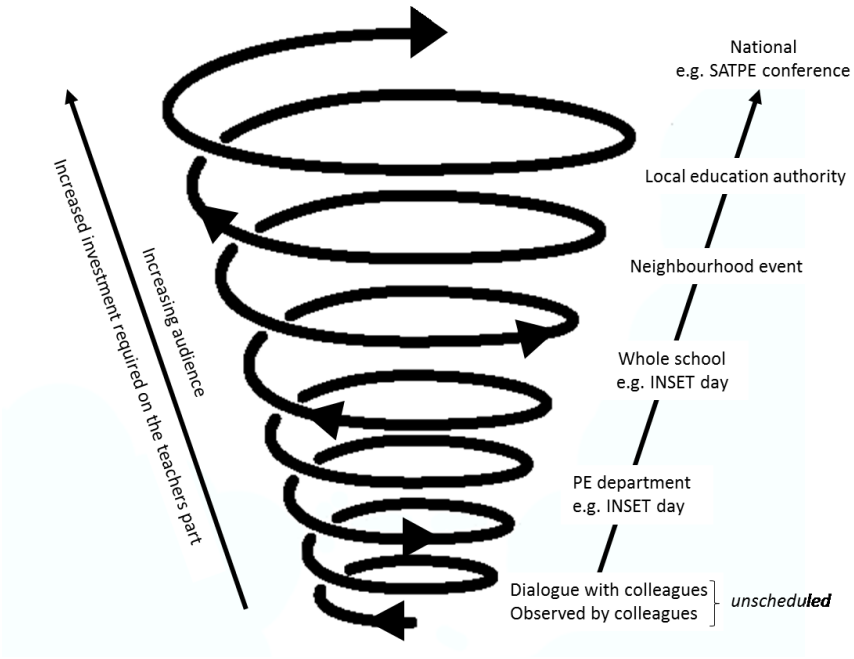


Figure 4.1: The trajectory and manner of the teachers' involvement in leading professional learning.

Several participants acknowledged that involvement in leading professional learning resulted in further demands on their time. Their participation at such events led to them being perceived as authorities on the use of technology within PE, and on occasion beyond their subject area. These teachers reported becoming the go-to people for colleagues seeking advice or assistance with technology related issues. For example, Linda described how she assisted staff within her department with problems they encountered with technology:

> But some of my colleagues, I'm definitely their supporter more so, like they would maybe wouldn't go to [name removed of the teacher with a remit for matters concerning ICT] but I'll be their support…So I think it's within the faculty, like I was helping [name removed] in SCT the other day with a wee something…
>
> Linda - 31st May 2016

For others this role extended to colleagues out-with the PE department, as illustrated by Mick: *'I have been asked by PT's of other departments in the school about the ICT that I've done, so they're keen to get practice shared…'* (20th May 2016). For Brian this position continued beyond school: *'A lot of my colleagues, I suppose, the people that I follow* [on twitter], *people that are friends…I'm still in touch with a number of folk at university who ask me for advice, ask me for help'* (1st February 2016). Bill enjoyed an even greater profile, being perceived as the go-to person for technology beyond his department, school, and authority:

> …I get asked, you know, for help from people from all over the country. I get phoned up and even the Apple shop are on at me to help. A name was passed on and they asked me to support someone that was up in [name of school removed]
>
> Bill - 26th February 2016

4.3.3 Involvement in working groups

In addition to undertaking their own professional learning, as well as leading it for others, several participants, namely Brian, Charlie Keith, Linda, Mick and Ronnie, were actively involved in working groups focused on the use of technology in their schools. Again these teachers reported a willingness to be involved in those groups, as illustrated by Linda when describing how she put herself forward for the working party at her school, as well as a wider taskforce within her local authority:

> …there's a list and you get to opt into whatever one [school working group] is interesting for you, whatever you would like to be doing. So I went with ICT because it's what I'm doing quite a lot and the time…With this [name of local

> authority removed] one, the PE one, it was emails out by I think it was our PELO [PE Lead Officer]…I think she emailed out originally for interest and…I was yes, sure I am on it.
>
> Linda - 3rd March 2016

The notion of participants being proactive in matters to do with technology established earlier in relation to professional learning (see 4.3.1 and 4.3.2) was also apparent in many teachers' accounts with respect to working groups. For example, Ronnie claimed to be the catalyst for the introduction of a working party at his school. Moreover, he indicated that he led the group, providing both the direction and impetus for the initiatives they took forward:

> …I met with the head teacher at the start of the year, and we were quite keen to get like a working group going, so…And I now lead that in the school, a technology kind of working group.
>
> Ronnie - 18th March 2016

Brian was also a central member of a working group at his school. Like Ronnie, it transpired he provided both leadership and energy with regards the conception and promotion of technology initiatives within his school: *'I'll sit down with the working group and I've said to them, where do you think we need to go?'* (Brian - 1st February 2016). Thus, it seemed that several participants had, of their own accord, acquired positions that afforded them the opportunity to take forward an agenda for technology use within their schools. It was also apparent that assuming such responsibility required these teachers to invest further time and energy to technology related matters as they undertook duties on behalf of the group.

Despite their respective working parties appearing to have wide ranging remits, the teachers' accounts suggested a modest investment of time was required attending group meetings, as illustrated by Linda: *'I think there's maybe about five within the academic year, set meetings or set times…'* (Linda - 3rd March 2016). With others there was a sense of frustration at not being able to meet more regularly, with Brian stating *'...we're only meeting every three or four months to do this'* (Brian - 1st February 2016), and Ronnie commenting: *'We've only met about four times this year, so we've not met near as much as we'd have liked'* (Ronnie - 18th March 2016). Further disappointment was apparent in Mick's narrative when he claimed that the school working party he had opted onto had failed to meet at all: *'I am part of the ICT group that hasn't met yet ever since I started in August…'* (5th February 2016).

Though demands on these teachers' time attending working group meetings was nominal, the investment of time and energy required to take forward the ambitions and initiatives of the groups was sizeable. A sense of the volume, as well as the nature of the work the participants undertook on behalf of the group was evident in Linda's narrative:

> So we mainly started it by let's…let's pilot a class each of this app and see how it goes. We'll work through the problems. So within that group we've created a kind of help guide that's very kind of basic screenshots of step-by-step how to set up…For the staff, how to set it up and we add in things… Like so throughout we notice little things here and there that takes a while to kind of realize and that all goes into this help guide. We have shared that with people.
>
> Linda - 3rd March 2016

These participants were again aware of the investment required by them and other group members in order to realise the aims of their working groups, with Brian

acknowledging it was a *'...slow process...'* (Brian 1st February 2016), and Charlie describing it as a *'...long game...'* (Charlie - 8th February 2016). Moreover, there was an appreciation that an ongoing, long-term investment of time and effort would be required by them - though they seemed comfortable with this. Reasons why the teachers' *weighted investment* was long term and likely ongoing will be discussed in Chapter 6, and I will examine why they appeared to be comfortable with those circumstances in Chapter 5.

Finally, as the participants' accounts unfolded the interrelated nature of their *formal* practices became more apparent. For example, taking forward the initiatives of the working group often involved the teachers organising or leading some form of professional learning event or workshop within their school or authority. This was typified by Linda when she spoke about leading whole school sessions as part of her schools in-service programme. Consequently, the theme and content of the in-service workshops had arisen from discussions and work undertaken by her working group:

> …I think the last one [in-service day] coming up we are actually presenting what our [working] group has been working on to the staff and hopefully in that we can share some ideas.
>
> Linda - 3rd March 2016

4.4 Informal investment

Although the behaviours presented in the following section are categorized as *informal,* that is not to say they were considered less important by participants. On the contrary, it seemed these teachers believed some of their less obvious habits and practices were more valuable in terms of developing their knowledge and expertise in technology in comparison to some of the *formal* behaviours described previously. The

perceived importance and value attached to those *informal* practices was evident in the time and effort these teachers claimed to have invested in them, as well as the manner in which they spoke about them.

4.4.1 Technical duties

Despite eight out of nine participants indicating they had access to some form of technical support at their school or within their authority - such as a dedicated technician, many of them claimed to regularly undertake such duties themselves. Moreover, it was questionable whether the tasks they reportedly undertook would be considered part of their wider teaching remit or their role as a physical educator. The teachers described undertaking duties to maintain the working order of their schools devices, as illustrated by Keith - duties a technician might be expected to carry out:

> It's just the updating things, the software that needs updated every now and then. Maybe once after every term I'll take them home and clean them, i.e. videos, photos, keep what we need to get rid of what we don't need type thing.
>
> Keith - 24th February 2016

It also emerged that many participants frequently carried out those duties at home, out-with school hours, in the evenings, at weekends and during holiday periods. Consequently, these teachers maintained that much of this work went unseen by their colleagues, as illustrated by Bill:

> There's some times that I could spend maybe four or five hours at home just by the time that I've gone through, got all the updates, downloaded things etc., but what it means is that when me, the pupils or my staff come to use it, it's there for them. That's probably why my staff are adopting this technology because I kind of do a lot of the stuff behind the scenes.

Bill - 26th February 2016

Again, the teachers were aware of the sizeable time and effort spent undertaking those duties, but once more appeared comfortable with the arrangements:

> Shirley: Yeah it takes a long time.
>
> *Me: But you don't mind doing that?*
>
> Shirley: It's fine. But, I mean, even just taking home the five iPads I did to update, just do the updates, you know, that's a whole evening gone.

Shirley - 29th February 2016

Finally, some participants attempted to quantify the time spent on technical related tasks, for example, Bill highlighted it took four or five hours, whereas Shirley indicated it took a whole evening to update the departmental iPads. It is conceivable that their investment was even greater than reported given how well resourced participants claimed their schools and departments were when it came to devices owned. As Charlie commented: *'The amount of iPads we've got, we're swimming in them'* (8th - February 2016).

4.4.2 Practitioner conversations

It became apparent participants regularly spent time engaging in dialogue with colleagues and others on matters concerning technology. The conversations described by these teachers were somewhat synonymous with professional dialogue, namely the discussions were purposeful, with a focus on developing their knowledge and expertise, and had an emphasis on sharing ideas and practices with technology (see

Cheng and So, 2012). However, those conversations are categorized here as *informal* as they appeared to be impromptu, lacking the organization, structure, and formalised agenda normally associated with professional dialogue.

Participants indicated having regular conversations with their immediate colleagues, namely other PE practitioners within their department:

> [name of teacher removed] was in the department…he was really into technology, so the pair of us kind of pushed each other on. Look what this can do, look what that can do, I've been speaking to this guy, he showed me this. So we kind of…bounced ideas off each other So we really kind of drove things on and we were being innovative. And, you know, it was really quite exciting and addictive I found, you know, it gave me a real spark in my teaching as well.
>
> Bill - 26th February 2016

It appeared such conversations were not restricted to PE colleagues, with several participants also highlighting frequent exchanges with colleagues from other subject areas in the school:

> Hearing and sharing practice within the school even…[name of teacher removed] is our CL [Curriculum Leader] of technologies he's also a basketball player and we share an interest in Basketball and started talking about different apps that he was using, that I was using. So yeah just kind of through conversation even…
>
> Linda - 3rd March 2016

Those conversations were not exclusive to teaching colleagues, with exchanges taking place between participants and support staff, as illustrated by Keith when recounting his early experiences using Google Chromebooks: *'I was in a lot of discussion with*

the technicians to see how we can do it...what can we do, can we get this and so on' (Keith - 24th February 2016). Some teachers also reported engaging in similar types of conversation with pupils. For example, Mick described how he would regularly find out what technology the pupils used out-with school with the intention of involving it in his lessons:

> Snapchat's getting used heavily now, so you do Snapchat tasks in class and, you know, and you just ask pupils what they're using right now because it changes constantly. And it makes it appropriate to them.
>
> Mick - 20th May 2016

It also emerged these teachers engaged in conversations on such matters beyond the school with persons from other schools, authorities and sectors. Brian, Keith and Faye described how they would often speak with former colleagues based elsewhere in the country, whereas Bill described the frequent dialogue between himself and colleagues from other schools within his local authority. Bill also recounted conversations with the developer of an app that he used in his teaching, in order to: *'...pick their brains and ask them little bits and bobs'* (Bill - 24th May 2016). Furthermore, the exchanges that took place were not always in person. The participants claimed to regularly use technology itself, in particular social media platforms, to connect and engage in conversations with a wider, like-minded audience - as illustrated by Bill:

> …in my own time and I just, you know…spend a bit of time and quite often it's just, it's on the iPad…And because I've got this sort of network of people that I follow on Twitter and Facebook…you know, stuff that they post, I think, that sounds brilliant…And then from there sometimes I approach those people directly through Twitter or I e-mail them and

> find…find stuff in conversations with them, ask them how they did things as well.
>
> Bill - 26th February 2016

Another feature of the conversations that took place, evident in Bill's excerpt, was the active role participants played in the exchanges. It emerged they were proactive in initiating many of the exchanges described in their accounts.

Finally, a sense of the time these teachers devoted to those conversations was evident when the range of persons they highlighted having discussions with was considered, such as PE colleagues, colleagues in other subject areas, support staff, pupils, and so on. Also, the manner in which the participants engaged with those people, for example face to face, as well as through social media, gave a sense of the effort required on the teacher's part. Similar to the technical duties assumed (see 4.4.1), much of the time devoted to engaging in practitioner conversations appeared to be in their own time. The teachers seemed to be aware this was the case, and the time they spent engaging in such discussions, but again they appeared happy with those arrangements.

4.4.3 Campaigning

These participants understood that colleagues did not always share their interest and enthusiasm for using technology. They also recognised that colleagues did not engage in the same habits and practices with technology they themselves claimed to. Though their accounts focussed mainly on their teaching colleagues, the participants also acknowledged that non-teaching staff, in particular senior managers, were often less enthusiastic about the use of technology in their schools. Consequently, given their own experiences and interests these participants inadvertently assumed a campaigning

role which involved them investing further time and energy promoting the use of technology in their schools and beyond. Though they did not necessarily perceive themselves occupying such a role, they were all proactive in their endorsement of technology, or as Ronnie put it: *'...getting the message out there...'* (18th March 2016). Their intentions being to convince colleagues of the merits of using technology in their teaching, by getting them *'...to open their eyes...'* to it (Charlie - 8th February 2016), and to *'...buy' into it* [technology]*...'* (Ronnie - 18th March 2016).

The role of campaigner, and the practices associated with it, was perhaps more subtle and less obvious than some other habits discussed elsewhere in this chapter. It seemed participants' campaigning was often carried out in conjunction with other *formal* and *informal* practices described, such as *leading professional learning* (4.3.2), *involvement with working groups* (4.3.3), and engaging in *practitioner conversations* (4.4.2). For example, Bill recounted an impromptu conversation regarding formative assessment between himself and two colleagues within his faculty. He went on to describe how he brought the conversation round towards technology, in particular championing the platforms he used to formatively assess pupils during his lessons. Bill then explained how the conversation resulted in him organising a session with his colleagues to demonstrate the merits of the technology (see Bill - 26th February 2016). Moreover, many of these participants also appeared to appreciate their involvement in professional learning and school working groups afforded them an opportunity to take forward an agenda for the use of technology in their schools.

Finally, the teachers indicated that convincing colleagues and others of the merits of using technology was not always a straightforward task. They understood that

challenging others assumptions and beliefs was an ongoing process that took time. On this point Brian remarked *'...there's a lot of spoon-feeding. It's, I suppose it's trying, it's changing their mind-set'* (1st February 2016). A sense of the effort and commitment required by them in order to do so was evident in others accounts, in particular Charlie who commented: *'They couldn't see the value of it. And you're banging your head off a brick wall going right, okay...How do I convince them? How do I show them this makes a difference?'* (8thth February 2016). The protracted nature of the role was perhaps best encapsulated by Ronnie when discussing the challenges of taking forward the aims and initiatives of his school's working party for technology:

> …some of the departments have started to buy into this [OneNote and Flipped Learning]. I mean it's a slow process, but I think we're starting to get there a little bit…people may be changing their mind set a little bit.
>
> Ronnie - 18th March 2016

4.4.4 Exploration and (re)search - online

The importance participants placed on their own professional development using technology was highlighted earlier when considering *formal* practices (see 4.3.1). However, these teachers also described undertaking a set of alternative *informal* practices in order to develop their knowledge and expertise in this area, as typified by Bill's comments:

> But a lot of my CPD is actually done in my own time online, watching videos in forums, on Twitter, downloading apps and playing around with them and seeing what works. Doing that rather than going to formalised courses.
>
> Bill - 24th May 2016

The teachers placed an emphasis on online research, to search for new devices, applications, and approaches that might enhance their learning and teaching practices. Though participants described such practices as research, exploring and searching are terms that perhaps better represent what they did.

All participants reported similar approaches for seeking out and learning about novel technologies. These included rudimentary investigative strategies as illustrated by Mick *'...I'm always trying to type in different buzz words in Google and Bing, etcetera…'* (Mick - 5th February 2016), as well as more refined methods involving online learning networks that these teachers were part of. For example, Charlie discussed his use of social media for such purposes: *'To be honest, social media is the best places…I mean Twitter's fantastic for just picking up stuff and having a think, looking at it, reading it, following your nose…'* (Charlie - 8th February 2016). The social media platform Twitter afforded participants opportunities to connect and converse with other practitioners, for example, asking other teachers for suggestions, as well as advice on how to use certain technologies within PE. Two participants - Bill and Mick claimed they frequently shared their own practices online via social media and personal blogs. Thus, networking sites provided a platform for these teachers to further engage in some of those practices previously described, for example *practitioner conversations* (4.4.2), as well as *campaigning* (4.4.3) and championing technology via their tweets and blog entries:

> I put a lot of stuff out over Twitter and bits and snippets and that's great and that's where I get a lot of my information…I speak to people and follow people. And that's like a whole learning network for me…

Bill - 26th February 2016

A sense of the time and energy these teachers spent exploring and searching online was apparent in their accounts. Yet again, they were conscious of the extent of their investment, with many participants maintaining that most of the work occurred out-with their normal school hours, in the evenings, over weekends and in some cases during annual leave (see Shirley - 29th February 2016). Nevertheless, the practitioners maintained the time and effort they spent online was necessary given the amount of content and information available. Mick remarked much of the content online was unsuitable, before highlighting a need to scrutinise any new technologies found:

> And like there's all sorts of weird and wonderful profiles popping up now that are like, ICT and PE and ICT Class and like, I don't know, like iPad apps PE. There's just lots…Some of the stuff is, like thin it's doing something for the sake of doing it. So you just have to, you have to sift through a lot…'

Mick - 5th February 2016

Finally, the scale of these teachers' online habits was also evident in their accounts, and in some cases quantifiable. Similar to what has been reported elsewhere in this chapter in relation other practices, the participants' commitment towards developing their knowledge and expertise in technology had been long term, with Brian claiming: *'I've learnt more on Twitter in the last five years than I have in the previous seven years'* (Brian - 1st February 2016). Furthermore, it was clear their investment was ongoing, as typified by Bill when he maintained: *'I have always kind of got my finger on the pulse looking for what is coming.'* (Bill - 24th May 2016).

4.4.5 Exploration and (re)search - the 4P Process

The final *informal* practice, or rather series of practices which emerged, concerns a set of discrete behaviours undertaken by participants. Moreover, they believed following those practices, in the order they did, enabled them to involve technology more effectually within their teaching. When describing the set of practices undertaken many teachers referred to it as research. The process did appear to involve many features synonymous with practitioner enquiry, namely it was investigative, systematic and their findings often shared with others (see Menter, Elliot, Hume, Lewin and Lowden, 2011), yet it would be difficult to define it as such given the intuitive way the teachers went about those practices. This final section of the chapter will proceed by describing each stage of what I have termed the *4P Process*: Pinpointing technology, Playing with technology, Piloting technology, and finally Putting technology into practice.

Pinpointing

This initial stage of the *4P Process* was one whereby participants sought out novel technologies they believe had the potential to enhance their learning and teaching practices. The interrelated nature of the different *formal* and *informal* practices was apparent during this initial stage of the process. For example, the teachers recounted the discovery of new technologies was often as a result of undertaking one or a combination of the practices previously described in this chapter, such as *engaging in professional learning* (4.3.1), *involvement in working groups* (4.3.3), partaking in *practitioner conversations* (4.4.2), as well as *exploration and (re)search online* (4.4.4).

Playing

In this stage the teachers explained how they would proceed to try out new technologies they came across on themselves, or other parties. For example, Faye highlighted testing it out on colleagues, whereas Mick claimed he tried it out on his partner, while Charlie described an occasion he had used new technology with a sports team he was involved with. Charlie went onto justify the use of non-school groups during this stage, claiming it provided an environment where he could afford to take risks:

> So that's where I kind of really first experimented with those sorts of things before taking it into the class. And having that area outside the classroom, if I didn't get it right, it wasn't a disaster.
>
> Charlie - 8th February 2016

Many participants explicitly referred to this stage of the *4P Process* as playing with technology, as illustrated by Shirley: *'So, I kind of, like to play around with it myself, try it out…'* (29th February 2016). The teachers claimed that playing with the technology was important as it allowed them to explore and learn about the features and functions of it, or as Bill put it: *'…to see how the technology works, what it does.'* (Bill - 26th February 2016). Additionally, participants reported that playing with technology allowed them to evaluate the effectiveness of it and consider how it might add value, or not, to their teaching and learning: *'I look at it and I think would that work with my kids that I have?'* (Faye - 24th February 2016). This stage also seemed to be important in enhancing their confidence with the technology. As Ronnie maintained, rushing it into lessons would result in problems:

> …I think if you just put it [technology] out there and try and do it all at once, you're going to give yourself issues as well, and you're going to possibly put yourself off, and put pupils off if you're going through it first time round with everyone.
>
> Ronnie - 18th March 2016

Finally, similar to the practices undertaken in the initial pinpointing stage, this playing phase often took place in the teachers' own time. For example, Faye described spending her non-contact time at school playing with technology, whereas Mick reported devoting time in the evenings and at weekends engaging with it.

Piloting

The piloting stage involved participants trying out the technology in more conventional settings, namely within lessons. For example, when discussing his initial use of Google Classroom Bill acknowledged that despite playing around with the platform there was much that remained abstract about it. In order to fully realise its potential, as well as to understand any shortcomings required Bill trialling it with a class: *'I need to actually do it, use it, work through it, okay, this works, okay, that's a nightmare.'* (Bill - 26th February 2016). However, participants indicated that they were unlikely to pilot technology with any class. They selected particular groups, taking into consideration factors such as their age, size, as well as the nature of the activity to be taught.

The teachers' accounts indicated this part of the *4P Process* was more protracted than previous stages. The piloting was cyclical in nature, with participants often undertaking a number of successive trials with different classes, pupils and activities,

making refinements to either or both the technology and their practice with each pilot, as illustrated by Faye:

> So, I try it [technology] in different activities and try to, with the app spin it…I tried to do it as a warm up in the class and they didn't really engage with it but then I changed it to be skill based and they really took to it in that regard. So, just changing little things…
>
> Faye - 24th February 2016

If the technology made it through to the piloting stage participants seemed to be aware of the possibility of it adding some value to their teaching and learning - even if they were unable to realise the potential immediately. Thus, they were prepared to persevere and continue to pilot the technology at this stage:

> …if they [technology] don't work there must be a reason that it hasn't worked so I'm going to try it again. Maybe in a different way with a different group and see if it works different...I don't just pick Apps and go right, I'll just give that a try and hope that it comes out well, there's reasoning behind it.
>
> Faye - 11th May 2016

Similar to previous stages the teachers' narratives indicated that an ongoing evaluation of the technology was occurring during the piloting phase. This constant questioning and reflecting on a range of issues concerning the technology was evident in the previous extracts from Faye where she reflected on the pupils she used it with, her teaching approaches, as well as the activity being taught (see above). Considering such matters was integral to the *4P Process* in order to judge the value and efficacy of the technology, as well as establishing the most appropriate practices and contexts in

which to use it. As part of this review process, several teachers indicated they also sought out the views and opinions of colleagues - by engaging in *practitioner conversations* (4.4.2), as exemplified by Bill earlier in the chapter (see p.114-115), as well the thoughts of pupils as illustrated by Mick:

> …if I ever try a new app or a new method, I always ask them [pupils] afterwards. I'll pick out a few in particular and say, you know, did you enjoy it?...Would you do that again? How would you want to change it?
>
> Mick - 5th February 2016

Putting into practice

In this final stage participants explained how they would involve a refined version of the technology in their teaching. Doing so was not always a speedy process though, with much groundwork required to ensure the technology was used effectively. Participants explained this involved teaching pupils how to use the technology, as well as establishing specific boundaries, namely what it was to be used for and what it was not to be used for. The teachers were explicit in terms of the time they devoted to these matters - ranging from a small part of a lesson through to whole periods, and in Keith's case a series of lessons when introducing OneNote to his National Qualification classes (see Keith - 12th May 2016). Several teachers also highlighted they spent time developing the right ethos and culture in lessons to ensure pupils understood the technology was an important tool that could support them in their learning. As Bill commented: *'...part of what I am doing is showing them that it doesn't just all have to be about taking selfies…That you can actually use this for meaningful learning as well'* (24th May 2016).

Understanding the *4P Process* as recurring gives an indication of the time and effort participants invested in it. For example, each time these teachers pinpointed a new technology they would work through the process in the order and manner described. Given how committed and proactive they seemed when it came to exploring online, engaging in conversations, attending professional learning events and so on it was likely they came across many novel technologies, and subsequently went through the process many times. Though, scrutinising every new technology they came across in the manner described would not be possible. It became apparent that not all technologies made it through each stage of the process with many disregarded during the initial stages, as illustrated by Brian:

> I mean, there's loads of things I've tried and gone, no, that doesn't work or we need to pay money for that. So for all the good things I use, I've probably tried two or three other ways to get there. And there's, for every app, there's another 20 other apps that do the same thing.
>
> Brian - 1st February 2016

Having established how demanding, timewise, the *4P Process* was, Brian's comments also illustrate the ongoing intellectual investment required. However, this constant scrutiny throughout the process enabled these participants to arrive at an informed decision about whether to proceed with the technology to subsequent stages in the *4P Process*, and ultimately involve it in their practice, or disregard it.

Finally, it is important to understand this questioning and reflection was not a discrete part of the process, rather it was ever-present and ongoing throughout the *4P Process*. It is also important to understand the extent of the teachers scrutinising of new

technologies. Using Larrivee's (2008) framework, which distinguishes different levels of teachers reflections, these participants at first appeared to be reflecting at the first level, focussing on the *'...functions, actions or skills..'* (Larrivee, 2008 p.342), of the technology used. Upon closer examination it emerged participants' reflections were more advanced, considering issues such as the theory and rationale behind the technology and their practices with it - indicating their ability reflect at the next level of Larrivee's (2008) framework. Reflecting on those types of issues required greater intellectual investment than those entry level concerns. Several of the teachers implied they distanced themselves from the technology in order to be more critical. This notion of extricating themselves to appraise the technology more effectively is illustrated in Charlie's comments on the use of iPad apps in PE:

> …what you have to do is step back and evaluate how useful are these Apps? And this is the gimmick that people are going, it makes it better so we can use photo finishing on the 100 metre sprint. Oh, the kids love it, so what? What did they do 20 years ago? There are kids now going you're first, second, third, fourth, it still brings you to the same outcome. So it's nice technology but is it relevant useful technology? And I think the fact that this is misguided information, people's ability to stand back and evaluate. Actually go well what do these Apps actually offer? What do they actually do? What difference do they make to my class? ... Stand back and question and reflect.
>
> Charlie - 13th May 2016

Lastly, there was little evidence however, of participants operating at the upper level of the framework, with little consideration of ethical, socio-cultural and political issues associated with their use of technology. For example, consideration of those wider issues and debates around technology and education that were discussed in Chapter 2 (see 2.5).

Chapter 5 Explaining teachers' *weighted investment* in technology - personal and professional motives

5.1 Overview

The following chapter addresses the second of the three specific aims presented at the end of Chapter 2 (see p.48), namely to develop a more nuanced understanding of reasons why PE teachers in Scotland use technology. In order to do so I focus on developing an increased understanding of the *weighted investment* framework presented in the previous chapter (see fig 4). In particular, I attempt to explain *why* the teachers, knowingly or unknowingly, engaged in the *formal* and *informal* (see 4.2.2) habits and practices represented in the framework. More specifically, I aim to develop an appreciation of *why* these lead users were seemingly predisposed to technology, devoting a sizeable time and effort on those practices associated with its use. The chapter will proceed by presenting and examining reasons given by participants for why they involved technology in their practice. In addition, I will draw on findings from literature reviewed in the opening chapters in order to present a more sophisticated understanding of the concept, as well as to substantiate my own results.

Before proceeding to examine some of the reasons given by these teachers for why they use technology, it is important to acknowledge the motives discussed are not discrete from one another. Though presented here in such a manner for purposes of clarity (see fig. 5), this was not necessarily how they were reported or viewed by participants. Rather, their motives appeared interrelated, with all of them influencing to varying degrees these participants' habits and practices with technology, as well as the time and energy they devoted to it. It is conceivable that some reasons reported

were more influential than others. However, no attempt has been made to distinguish which were more significant, or to rank the participants motives in terms of perceived importance or influence. My intention was to capture the interrelated and accumulative nature of those reasons, to better explain and understand how they collectively shaped and affected the teachers' *weighted investment* in technology.

5.2 Teachers' justification for their *weighted investment* in technology

Accounting for their *weighted investment* in technology, all participants reported multiple motives for why they used it. Bill, when questioned about his reasons, claimed he used technology for: *'A whole, whole range of things…'*. Bill went on to provide examples, before reaffirming the extent of his motives claiming he used it for: *'...a myriad of reasons'* (Bill - 26th February 2016). This general finding is consistent with results from Ottenbreit-Leftwich's *et al.* (2010) study, namely that teachers do not cite singular reasons for why they use technology, but rather provide numerous, interconnected motives for involving it in their practice. As well as citing several long-established reasons for using technology, such as for: *'improving learning (e.g. making learning more social' situated' or 'authentic') or improving learners (e.g. getting them engaged, motivated or able to learn)…*[as well as for] *'enhancing', 'enabling', 'assisting', 'supporting' and 'scaffolding' learning'* (Selwyn, 2016 p.6), participants also disclosed a series of personal and professional motives not widely reported in the literature. For example, all participants described the *enjoyment and reward* their pupils got from using technology in lessons, but also discussed the *enjoyment and reward* they themselves got from their reported habits and practices with it (see 5.2.1).

It is beyond the scope of this chapter to discuss all of the reasons cited by these teachers. Given previous research examining the impact of technologies in schools has focused predominantly on matters concerning the learner (see 1.4.2), I will focus here on the more personal and professional motives cited by these teachers that are less widely reported, namely: the enjoyment and reward participants got from involving technology in their practice; a perceived professional obligation on their part to use it; the values and beliefs they held with respect to its use; and finally career related opportunities they believed technology afforded them. I will also consider how those motives manifested in these teachers' everyday habits and practices with technology in order to understand how they influenced their *weighted investment* in it. Lastly, focussing on matters concerning the teacher as opposed to the learner - in this case the personal and professional reasons reported by participants for using technology, may also go some way to addressing Casey's *et al.* (2017) appeal for developing greater awareness of *why* teachers, particularly those who teach PE, involve it in their practice.

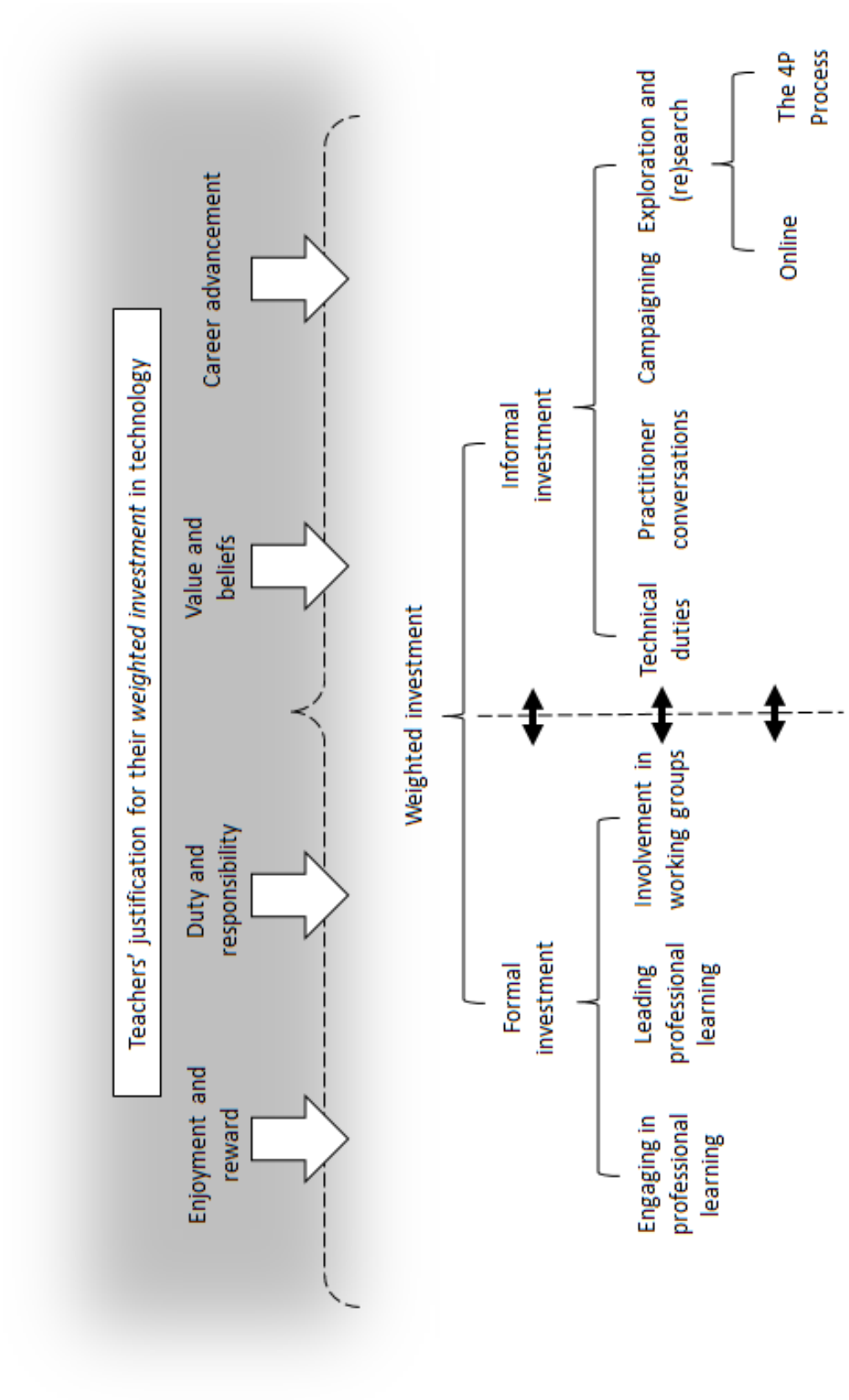


Figure 5: Teachers' justification for their weighted investment in technology - personal and professional motives

5.2.1 Enjoyment and reward

A recurrent finding in the literature on technology use in education, from a general perspective as well as within PE, is the impact technology has on matters pertaining to pupil motivation, engagement, and subsequent levels of enjoyment reported during lessons (see BECTA, 2007; HMIE 2007; Hastie *et al*. 2010; Casey and Jones, 2011; O'Loughlin *et al.* 2013; Shewmake *et al*. 2015; Weir and Connor, 2009). In a broad sense the results from this study support those findings, as they also report a positive relationship between the use of technology and increased levels of motivation and enjoyment. Though, findings presented here, unlike previous research, relate not only to pupil satisfaction and enjoyment when using technology, but also that of the teachers.

All participants maintained they enjoyed using technology in their practice. This was evident in the manner in which they spoke about it, as well as the language used to describe their practices and experiences with it. For example, Linda claimed that technology: *'...can make you quite excited about teaching...'* (3rd March 2016). A point Bill elaborated on when he stated it: *'...was really quite exciting and addictive...'* (26th February 2016). Bill's remark about technology being '*addictive'* implied it was something he had increasingly devoted more time and energy to. Furthermore, the enjoyment reported by these participants was not restricted to the use of technology during their lessons. Mick revealed the satisfaction he got from persuading colleagues of the merits of using technology when leading professional learning:

> You need to push it [technology] a wee bit, because it's useful. And when people do it, like, as I said at the CPD, they were all, like, these are brilliant, and how do I use this one, how do I use that one and it was really effective...

In addition, it emerged these participants found using technology rewarding, not only on a personal level, but also professionally, with Bill describing how: *'...it* [technology] *gave me a real spark in my teaching...'* (Bill - 26th February 2016), while Brian maintained that: *'...*[technology] *keeps me refreshed...'* (1st February 2016).

Drawing together these ideas may help explain not only why the teachers' investment in technology was sizeable in terms of the time and effort devoted to it, but also long-standing and seemingly ongoing. They described their involvements and practices with technology as '*exciting'*, providing their practice with a '*real spark'*, as well as keeping them '*refreshed'*. Furthermore, their accounts not only referred to those feelings and responses arising from their use of it within lessons, but also from the habits and practices with technology out-with lessons. For example, the enjoyment and excitement Mick got from *leading professional learning* (4.3.2) with colleagues (see p.131). Emotions such as excitement and enjoyment are momentary and unlikely to sustain the long-term use and motivation to use technology reported by these participants. However, their willingness to regularly explore and search for new technologies and practices (see 4.4.4 and 4.4.5); to frequently engage in conversations with others on technology related matters (see 4.4.2); to regularly undertake professional learning for themselves (see 4.3.1) and that of others (see 4.3.2), would likely result in them regularly encountering novel ideas and technologies. Thus, providing participants with repeated '*sparks'*, allowing them to frequently experience feelings of excitement, and being '*refreshed'*, in turn maintaining their motivation, and in a self-perpetuating fashion prompt them to continue to invest time and effort in those *formal* and *informal* practices (see fig. 5).

Given the enjoyment and fulfilment they got from undertaking the various habits and practices reported in Chapter 4, it was perhaps unsurprising to find these teachers had developed an attachment to technology. A point typified by Charlie:

> …if you asked me to sit down and do monitoring and tracking, I'll avoid it like the plague…I'll do it because I have to do it. Not because I love it…But when it's [referring to technology] something that you love and you enjoy and you're engaged in, it doesn't seem like time.
>
> Charlie - 8th February 2016

Their affection towards technology may also explain in part why the teachers were prepared to devote sizeable time and effort towards it. A sense of the amount of time Charlie devoted to such matters was implicit in his remarks, and the enjoyment he got from his involvements with technology had a positive influence on the time he invested in it. Though I contend Charlie's perceptions of both the time and effort invested may be skewed as a result of his fondness for it. An appreciation of the amount of time and energy invested in technology was evident in others accounts. For example, Ronnie, like Charlie, acknowledged the outlay on his part, but he believed it was justifiable given the satisfaction he got from it: *'Naturally you invest time in things that interest you and things that motivate you'* (Ronnie - 12th May 2016).

Finally, it is important to acknowledge that although participants spoke at length about the personal enjoyment and reward they got from engaging with technology, their professional obligations and sense of duty, which I discuss in the following section, was closely associated with those motives, with the teachers' believing their *weighted investment* impacted positively on their pupils:

> I just find it [technology] excites me as well and I think that's a good thing because if you start getting bored in your teaching or you're not stimulated, then you're not doing the kids a good service and you're not doing yourself a good service either.
>
> Bill - 26th February 2016

5.2.2 Duty and responsibility

In Chapter 1 (see 1.3) I established technology use is increasingly promoted in educational policy and professional teaching standards (Pyle and Esslinger, 2014; Sinelnikov, 2012). Consequently, there is a growing expectation for teachers to incorporate technology into their practice (Barrett, 2014; Enright *et al.* 2017; Roth, 2012). Findings in this study do not support those claims, with participants indicating they did not feel bound to use technology though it is advocated in current CfE policy (see Scottish Government, 2009a) and existing GTCS teaching standards (see GTCS, 2012a)[8]. Despite their practices with technology appearing to fulfil the specific aspirations and requirements of both, these participants were not conversant with those aspects of either policy. Neither did they explicitly refer to the policies as a motive for why they involved technology in their practice. It did transpire however, that all participants felt a wider duty and professional responsibility to use technology, and did so of their own volition - as illustrated by Linda: *'I very much wanted to learn more about it* [technology]*...wanted to upskill myself...'* (3rd March 2016). Bill elaborated upon this point when he acknowledged a motive for using technology was to become a more accomplished and effective teacher: *'You know, that kind of motivation, I want to improve, I want to learn I want to know more…A lot of it is purely from me doing it for myself to get better'* (24th May 2016). This notion of professional

[8] It is conceivable teachers who lack a necessary knowledge and expertise, and who do not involve it in their practice might hold different opinions.

responsibility was perhaps best summed up by Faye who, like the others, believed it was her duty to undertake those practices and invest in her own development as a teacher: *'I just see it as a part of my job…developing myself'* (11th May 2016). Faye, along with others, felt a professional obligation to be as effective as they could in their role, and believed using technology allowed them to do so. Though not explicit within these teachers' narratives, recent emphases on career long professional learning (see Donaldson, 2011; Education Scotland, 2018; European Commission, 2015), as well as professional values and commitment (see GTCS, 2012b), may have in-directly prompted them to involve technology in their teaching practices.

The professional duty and responsibility reported by participants extended beyond their own learning and use of technology to that of their colleagues. Some of the teachers felt a professional obligation to share their knowledge and expertise in this area with others: *'I think you have to push it* [technology] *a wee bit, particularly if you have the knowledge and someone else doesn't'* (Mick - 20th May 2016). Charlie and Bill each discussed yielding to regular requests to lead professional learning events for colleagues (see 4.3.2) - though a sense of professional duty and responsibility was not the sole reason why those participants frequently led professional learning workshops and events for others. As indicated at the outset of the chapter (see 5.1), the teacher's motives were interconnected and they had an accumulative effect on the time and effort they invested in technology. For example, referring to Mick's comments elsewhere in this chapter (see p.133-134) applying the concept of *weighted investment* means viewing the *enjoyment and reward* (5.2.1) he took from enhancing the knowledge and skills of colleagues in this area, as well as the *value and beliefs* he attached to technology (5.2.3), as prompts for him to share his knowledge and expertise

in *formal* ways - through *leading professional learning* events (4.3.2), as well as in *informal* ways - through *practitioner conversations* (4.4.2).

Lastly, professional duty and responsibility, as a motive, may also in part explain the ongoing, long-term nature of the teachers' *weighted investment* in technology. Earlier in this section I portrayed these participants as extended professionals who aspired to be effective in their role as an educator (see Bill's comments p.134). Thus, it is unlikely they would resort to '*tick-box'* approaches to using technology described in Chapter 2 (see Goepel, 2012; Parton and Light, 2010). It was evident these participants were committed to using technology more purposefully: *'...I took it on myself to try and learn as much as I could about technology because I just saw there were so many possibilities...'* (Bill - 26th February 2016). Furthermore, they understood this would require an outlay of time and effort on their part, namely a degree of forethought, as well as undertaking relevant professional learning and development (see Pritchett, Wohleb, and Pritchett, 2013; Wiske, 2004). Being committed professionals they felt compelled and were comfortable investing time and effort in those habits and practices described in Chapter 4, such as *the 4P Process* (4.4.5), as they understood they would enable them to involve technology more effectively in their teaching.

5.2.3 Values and beliefs

The participants' positive values and beliefs, with respect to technology, emerged as another factor that influenced the time and energy they devoted to it. Faye's comments illustrate this idea more generally: *'...it's things I feel are important within my teaching I tend to spend more time on…than things I don't value as much'* (11th May 2016), before revealing in more explicit terms why she values technology:

> …because I think it [technology] enhances my teaching personally. And I think that for the pupils it makes their experiences in PE a lot more enjoyable…
>
> Faye - 11th May 2016

Similar values and beliefs were evident in all participants' accounts, namely the use of technology would enhance teaching and learning in their lessons. Thus, these teachers felt the time and effort they invested in technology was justified. This idea was exemplified more generally by Bill: *'...I definitely think I get a return on my investment'* (24th May 2016), and Keith when he maintained: *'...I don't mind doing that* [investing time and effort], *if it's going to benefit the pupils I'm all for it.'* (24th February 2016). Others were more specific about returns they had. For example, Charlie claimed *'...the upshot now is that time invested then…had a depth and impact on what I can now do with tech'* (8th February 2016). In addition, Mick believed time he had invested led to a freeing up of time: *'...it has saved so much time, whilst also keeping the quality of learning high'* (20th May 2016). Mick also felt this investment enhanced his confidence using technology and ensured his practices were both effective and evidence based: *'...I have put a lot of hours into the research that I've done, so I'd like to think that it was well informed…'* (Mick - 5th February 2016).

General values and beliefs reported by these participants with respect to technology use and schooling, as well as those specific to PE, broadly reflect those reported in the literature (see Bisgin, 2014; Gotkas, 2012; Kretschmann, 2015a; Lockyer and Paterson, 2007). Like Ottenbreit-Leftwich's *et al.* (2010) finding that teachers' report multiple, interconnected motives for using technology, the positive values and beliefs the teachers in my study had developed with regards technology were also wide

ranging and related. Though, it was evident their views had not always been as extensive or as well informed, as Faye illustrated:

> Yes, to begin with it was sort of just because...I quite like using ICT and I could see some of the benefits of it. But whereas now I think that reasons have broadened so now we can see rather than just it being engaging for some pupils. I can see that it can lead to deeper learning and...Yes, I think to begin with it was a case of me just using them [iPads] for the sake of probably using it because I know that it's something that she'd [her line manager] be promoting and it would engage students more. But I can [now] see more reasons for that, I can see more depth.
>
> Faye - 11th May 2016

As a result of their *weighted investment* not only did these teachers accumulate a greater knowledge and expertise with technology, but their views and reasons for using it also developed and became more sophisticated:

> …when you start using them [iPads] it's maybe one thing that you're doing and then you get more confident with it, you get more confident teaching with it, you maybe hear about other things…just through little bits of research here and there...I think you get more creative with it yourself because you're aware of more things you can do or you're more confident... definitely lots of reasons.
>
> Linda - 31st May 2016

It was apparent that there was a positive and direct relationship between time and effort invested in technology and the values and beliefs these teachers' held with respect to its use. Thus, as their investment in technology increased, for example the more time they spent *engaging in professional learning* (4.3.1), the more established their values and beliefs became. Furthermore, the returns the teachers got from undertaking those

habits and practices, such as *enjoyment and reward* (5.2.1), provided the impetus for them to continue devoting time and energy to those practices.

The nature and purpose of some of their *formal* and *informal* habits and practices were also important in strengthening these teachers' values and beliefs towards technology. For example, engaging in *practitioner conversations* (4.4.2), carrying out the *4-P Process* (4.4.5), as well as *exploration and (re)search online* (4.4.4) involved participants spending time and effort examining and scrutinising technology - before arriving at a decision about whether to involve it in their practice or not. Thus, these participants believed their views were quantifiable, as well as critically informed: *'...through trying out things, finding different apps, talking to different people; I started to really see the value that it* [technology] *can bring...'* (3rd March 2016). Moreover, their positive values and beliefs concerning the merits of using technology became more sophisticated and established as a result of their day to day habits and practices with it (see fig. 4), which increased the likelihood of them continuing to invest time and energy in it.

Finally, an increased disposition towards technology was most notable in the narratives of those teachers' that led professional learning sessions for colleagues (see 4.3.2). Their involvement and investment in technology was motivated by a firm belief that it enhances teaching and learning. Furthermore, they believed that convincing colleagues of this through workshops, as well as *practitioner conversations* (4.4.2) and *campaigning* (4.4.3), was both necessary and possible. The popularity of their workshop sessions, the feedback they received, as well as the impact they believed it had on those who attended their sessions likely provided the impetus for their

continued involvement in professional learning, as well as other practices, as Mick illustrated: *'So we did the CPD and it was all very, very positive, you know all the staff did use it…you know had the wee buzz, so they did use it'* (20th May 2016).

5.2.4 Career advancement

A final reason that helps understand and explain why participants undertook certain practices with technology, and devoted the time and effort they did, developed initially from the early career teachers' narratives. Several of those participants believed that acquiring knowledge and expertise in and with technology would be advantageous to their future career prospects:

> …job prospects, applications. It's a great thing [technology] to be able to put on applications, like your skill level within that. It's something that actually…I'm sure, thinking back…I think it's actually on a lot, the desirable content of a job application.
>
> Linda - 3rd March 2016

Ronnie supported this idea of career advancement, however, he suggested this reason was not a conscious one, or a primary motivation for investing time and energy in technology: *'...it's probably something that is going on without almost realising that you are doing it for your own progress as well...'* (12th May 2016). This idea of teachers' decisions to involve technology being more intuitive was supported by the more experienced mid-career teachers. Both Bill and Brian claimed technology had *'opened doors'* for them professionally, whereas Charlie was more explicit recognising the knowledge and skills he had acquired afforded him opportunities he had previously not imagined:

> …let's put it this way, I'm sitting in this role [digital learning coordinator] as a PE teacher, I'm not sitting here because of my ability to teach PE. I'm sitting here because I've got a skill set that nobody else has...
>
> Charlie - 13th May 2016

Similar to Ronnie's earlier remarks, these more experienced teachers also seemed reluctant to admit their investment in technology was primarily aimed at advancing their careers. First and foremost they claimed to be focused on developing their professional knowledge and abilities, as typified by Bill: *'...technology opened up certainly a lot of doors for me and I don't know if I saw it as a way of advancing my career, but I certainly did see it as a way of advancing me…'* (24th May 2016). An idea that supports notions of technology use being a professional *duty and responsibility* examined elsewhere in this chapter (see 5.2.2), and a further example of the interrelatedness of these teachers' motives.

Consistent with more general findings (Education Scotland, 2014; Condie *et al.* 2005; OECD, 2015a), as well as those specific to PE (Cengiz, 2015; Kretschmann, 2012; Thomas and Stratton, 2006), the participants were aware technology use was not routine in their schools and in their subject area - despite recurrent initiatives, programs and policies to support its use (see 1.3). Moreover, many of these teachers understood and admitted to developing their knowledge and expertise in this area order to enhance their future career prospects - as illustrated by Mick's comments about when and why he started using technology: *'Originally when I was at university it was actually because I was thinking about probation year and getting a job and what makes me different to other staff'* (5th February 2016). These findings are somewhat in accord with HE practitioners in Wolcott and Bett's (1999) study who believed using

technology allowed them to enhance their reputation, as well as create a niche for themselves within the sector. However, the author's acknowledged career enhancement was a subsidiary motive for their practitioners. Ronnie's comments, along with those of the longer serving teachers, appear consistent with findings from Wolcott and Bett's (1999) study. However, some of the early career teachers' accounts are somewhat contradictory. For example, Linda, Faye and Mick's accounts indicated that career advancement was a primary aim - initially at least:

> …knowing my PT, she's quite into using ICT. And then by me, obviously clicking onto that then I'm trying to get involved in as many things to do with ICT and promoting it within my classes. Because I obviously want to make it look as if I'm doing well…
>
> Faye - 11th May 2016

Though a prompt for those early career practitioners, it is questionable whether career advancement would sustain the ongoing *weighted investment* of time and effort reported by other participants, in particular Bill, Brian and Charlie. Those teachers were similar to the HE practitioners in Wolcott and Bett's (1999) study in that they had acquired a position within their departments, schools, and local authorities as a result of their knowledge and expertise with technology. A status they enjoyed, despite the implications - that is it required them to devote further time and effort towards technology related matters. Though appreciative of the position they had attained and the professional opportunities that had arisen as a result (see Charlie's comments p.140), those participants were adamant they had not purposely set out to use technology as a vehicle by which to enhance their status or advance their career, and as such this reason had never been a primary or deliberate one.

Finally, given the initial reluctance of many participants to talk about career advancement as a reason for using technology, it is perhaps unsurprising this motive is not widely reported in the literature. Though not a reason likely to sustain technology use over the long-term, it is a legitimate reason why teachers might consider using it in the first instance. Given the prominence of technology within current educational policy (Pyle and Esslinger, 2014; Sinelnikov, 2012), its use might become a pre-requisite for teachers looking to advance their career, and thus a more frequently cited reason for why teachers involve it in their practice. However, the experiences of these participants indicate that once practitioners begin using technology, and become more familiar and knowledgeable with it, their initial motives relating to career advancement are superseded by those more intrinsic reasons discussed earlier in this chapter (see 5.2.1 to 5.2.3). Furthermore, those other motives are more likely to sustain a more purposeful use of technology over a longer term.

5.2.5 Teachers' justifications - final thoughts

All participants maintained they were aware of the extent of their investment in technology - that is, the time and effort they devoted to those practices reported in Chapter 4. Overall, they seemed comfortable with this *weighted investment,* given the return they believed they got from it: *'It's time consuming but it's worth it'* (Faye - 24th February 2016). In addition, Keith remarked: *'I think because we do enjoy the type of stuff* [technology] *we're using and we do know that it* [technology] *works and we know the benefits and you just, yes, you don't mind'* (18th May 2016). Consistent with findings in the PE specific literature (Casey *et al.* 2017a; Hastie *et al.* 2010; Parker *et al*. 2017) participants in this study had undertaken *'an intensely personal and emotional learning journey'* in involving technology in their practice (Casey *et al*.

2017a p.249). Furthermore, they believed their journey with technology, characterized by the habits and practices undertaken (see fig. 4), was necessary in order to use it effectively - as Charlie illustrates it was a fundamental part of the process (or journey):

> But the one common thing that every single one of us has done is we've invested a little bit of time in it. We've taken the step of going do you know what? I'm going to sit here and solve this problem.
>
> Charlie - 8th February 2016

Despite participants' assertions that they were aware of the extent of their investment, I came to believe they were not as attentive as they thought. The teachers recounted the time and effort they spent on discrete practices, such as *exploration and (re)search (online)* (see 4.4.4) or *leading professional learning* (see 4.3.2). However, none of them discussed their investment in technology collectively (as presented in fig. 4), or acknowledged those habits and practices in accumulative terms. Thus, there was little indication of these teachers considering an overall picture, namely the scale and scope of their involvements with technology, and the collective time and effort they had invested in it.

In this chapter I have presented a series of highly personal and professional reasons for why these teachers involved technology in their practice - findings that broadly reaffirm Casey's *et al.* (2017a) suggestion that using technology is often an individual and emotive undertaking. Moreover, I contend those motives influenced their habits and practices - in particular the amount of time and effort they invested. Given the influence those reasons had on their *weighted investment* in technology, I believe they also affected their ability to be impartial when judging the time and effort they spent

on those practices. More specifically, the personal and emotive nature of their motives obscured these teachers' judgements, inhibiting their ability to ascertain the extent of their investment in technology. I will revisit and elaborate on this idea at the end of the next chapter in which I present further factors that I believe unknowingly influenced the participants *weighted investment* in technology.

Chapter 6 Explaining teachers' *weighted investment* in technology - the 'bigger picture'

6.1 Overview

The following chapter addresses the third and final aim of the study outlined at the end of Chapter 2 (see p.48), namely to recognize and develop an understanding of immediate, as well as wider factors that may directly or in-directly determine PE teachers in Scotland's everyday habits and associated practices with technology. In order to address this aim I present a more comprehensive understanding of the participants *weighted investment* in technology. In the previous chapter the emphasis was on explaining *why* these lead users knowingly engaged in the *formal* and *informal* habits and practices represented in the framework (see fig. 5). This chapter remains focused on technology use from a teacher's perspective, but is outward looking, focusing on a series external factors reported by these participants, namely their senior managers lack of knowledge and expertise with technology; the absence of a strategic overview for technology use in their schools; an emphasis on the procurement of technology at the expense of technical support, professional development and training, as well as the infrastructure to support its use within their schools (see fig. 6). I contend those factors - which I have labelled as *underlying*, unknowingly determined the teachers' habits and practices with technology, and influenced the amount of time and effort they devoted to it. Examining those factors will allow me to present a more comprehensive and sophisticated account of *why* these teachers were predisposed towards those practices and behaviours associated with the use of technology. Similar to the previous chapter I will draw on participants accounts, as well as findings from literature examined in Chapters 1 and 2 in order to legitimize and substantiate aspects

of my extended framework, and further explain the concept of a *weighted investment* in technology (see fig. 6).

Before proceeding it is important to acknowledge the underlying factors reported by these participants feature prominently in research literature on technology and schooling. For example, the absence of a strategic overview in schools is a recurrent finding in both national and international educational research and reporting on technology and education (see BECTA, 2006; HMIE, 2007; OFSTED, 2011; OECD, 2016; BESA, 2018). In keeping with the wider aims of this study presented in Chapter 1 (see 1.6), founded on Selwyn's suggestion for research to develop greater awareness of 'bigger picture' matters (Selwyn, 2017 p.vi), I will examine the impact those underlying factors had on the teachers' *weighted investment* in technology, as well as arrangements that led to those factors arising. Studying the settings and circumstances in which these participants practiced, and the causes will also address, in part, concerns highlighted at the outset of the study by Casey *et al.* (2017a), Gard (2014) and Lupton (2015) about the narrowness and lack of attention to wider contextual factors in previous PE related research in this area.

Consistent with how participants' motives were presented in Chapter 5, I will discuss each underlying factor separately. Though, I believe the factors presented here, along with those motives presented previously in Chapter 5, are interconnected, and influenced to varying degrees the teachers' habits and practices with technology, as well as the time and effort they devoted to such matters. In the discussion that follows I will attempt to portray the connected nature of the factors and the cumulative impact they had on the participants *weighted investment* in technology.

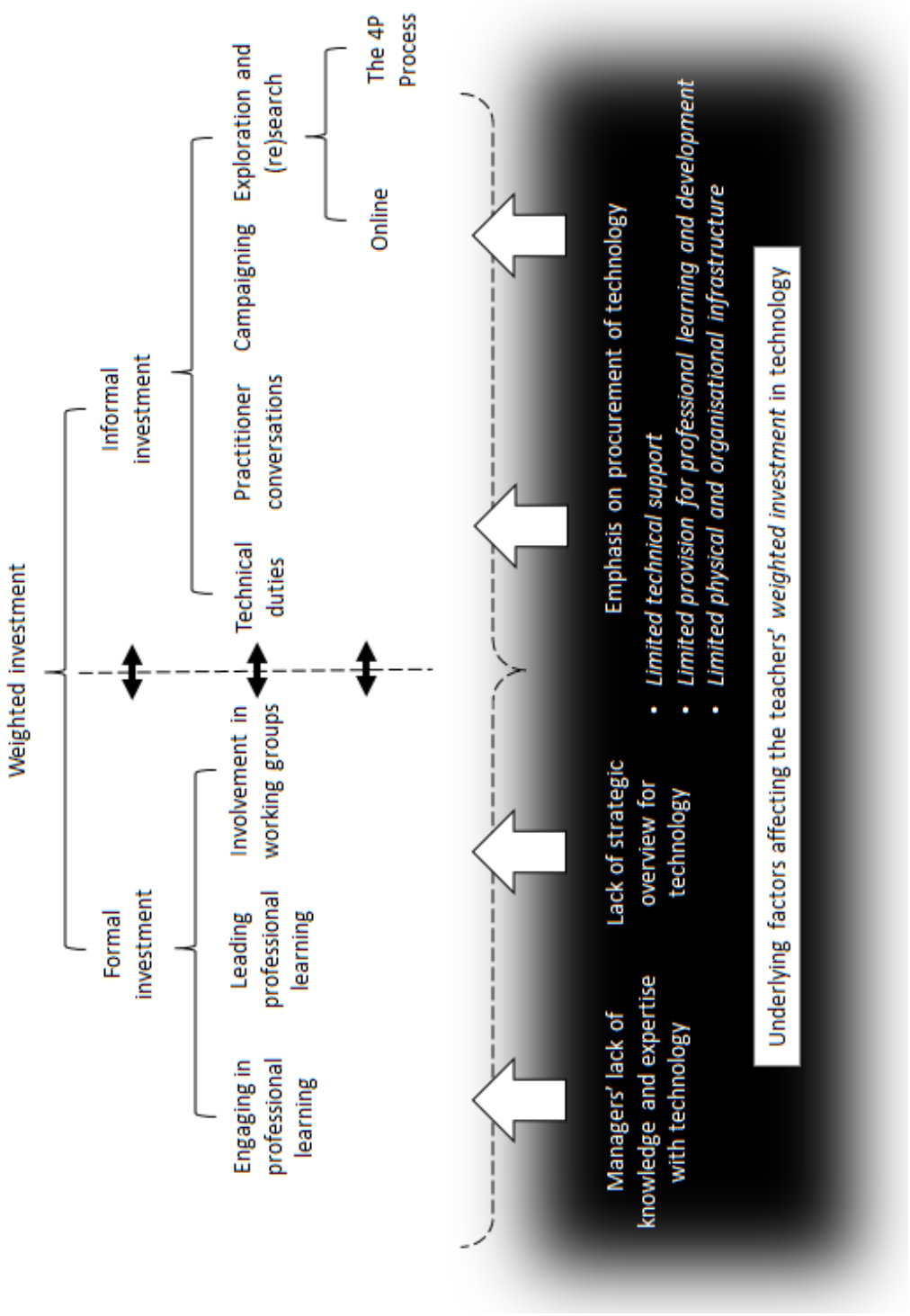


Figure 6: Underlying factors affecting teachers' weighted investment in technology - the bigger picture

6.2 Underlying factors affecting the teachers' *weighted investment* in technology

6.2.1 Managers' lack of knowledge and expertise with technology

Limited involvement

It is widely accepted senior managers are central to the effective implementation of technology in schools (Ottestad, 2013; Afshari *et al.* 2009; Hauge, Norenes and Vedøy, 2014; Hauge and Norenes, 2015; Tondeur *et al.* 2009), with the OECD (2015) claiming:

> The key elements for success are the…school leaders and other decision makers who have the vision, and the ability, to make the connection between students, computers and learning.
>
> OECD (2015a, p.191)

Participants in this study questioned whether their senior managers possessed those attributes highlighted by the OECD (2015a), or the motivation to take forward technology agendas within their schools. For example, Bill and Charlie claimed their school leaders lacked interest, as well as experience using technology for educational purposes: *'...they* [senior management] *are not really motivated or driven by technology or have had their eyes opened a little bit to it'* (Bill - 24th May 2016). Charlie elaborated, indicating school leaders he had worked with lacked: *'...the capability and knowledge and comfort with technology…'* (13th May 2016). The implications this had on their day-to-day practice was illustrated by Bill when he explained: *'...I don't think they* [senior managers] *know much about the technology and so they are quite happy for me to explore and make the mistakes and kind of go myself with it'* (24th May 2016). The absence of any direction from senior managers

meant these participants were afforded a degree of autonomy about how, when and why they used technology. In addition, these teachers were given a degree of latitude in other matters, for instance, when organising and *leading professional learning* for technology within their schools (see 4.3.2). For example, on such occasions the teachers decided the focus and content delivered in those events and workshops. Also, their *involvement in working groups* (4.3.3) was largely ungoverned with some participants given authority to determine aspects of their school's agenda for technology (see Brian and Ronnie's accounts in Chapter 4 - 4.3.3). These arrangements allowed these teachers to discover, devise and create with technologies, for example, *discovering* new devices or novel ways to use technology within their teaching; *devising* technology related initiatives within their schools and authorities; and *creating* resources and sharing them with colleagues during professional learning workshops and events. Given the higher-order nature of such practices it is assumed all would have likely required a sizeable cognitive investment by these teachers.

Several participants, namely Brian, Faye, Keith, Linda, Mick and Ronnie, *did* believe their senior managers were interested in technology use within their schools, despite their limited knowledge and expertise with it. Those participants maintained their school leaders were supportive of technology use, in so much as they actively encouraged staff to use it: *'...the head teacher, he tries to promote it* [technology] *as much and…I wouldn't say there's particular pressure coming really from above and forcing us to use it, sort of just on our own accord'* (Faye - 11th May 2016). Despite encouragement from their senior managers, Faye and the others were still left to decide whether they used technology or not. Moreover, when they did use it, like Bill and Charlie, those other participants were able to choose what technologies they used, as

well as when and how they used it. These arrangements, however, suited the teachers, despite the impact they had on their habits and practices with technology, and the time and effort they were having to invest in it. For example, undertaking *exploration and (re)search - online* (see 4.4.4), as well as going through *the 4P process* (see 4.4.5) in order discover and determine which technologies and practices were most appropriate and effective.

Though some senior managers were reportedly interested in the use of technology within their schools, none of them, apart from one, undertook a direct, hands-on role in such matters. Keith's deputy head teacher was the exception, overseeing his school's technology working group. However, Keith indicated the group had *'faded away'* as the senior manager - who provided the impetus for it, had other priorities: *'...the deputy who's in charge of that's* [technology working group] *doing timetable right now, I think he's swamped. I think that's just what it is, it just goes on a backburner'* (18th May 2016). Thus, senior managers might not be actively involved in taking forward a technology agenda within their schools, not only because they lack appropriate knowledge and expertise, but because there are other aspects of schooling deemed more important.

Valuing technology

Though these participants believed their senior managers lacked both capacity and confidence with technology (see Bill and Charlie's comments p.149), their accounts revealed their leaders did value the use of it within their schools. This idea was illustrated in Faye's earlier remarks about it being frequently promoted by her head teacher (see p.150). Previously in Chapter 5 I examined the positive beliefs these participants' held with regards technology and schooling, and how their *weighted*

investment in it may have shaped their values (see 5.2.3). Yet, how their senior managers came to value technology - revealed in their eagerness for their staff to use it, is more difficult to ascertain. The wider issues examined in Chapter 2 regarding power and control, hegemony, as well as the rhetoric often associated with technology and schooling (see 2.5) may help understand and explain how the positive values and beliefs of these participants' senior managers may have developed. With limited experience or knowledge to draw on in relation to technology use in schools, their managers may have been susceptible to the persuasive language and discourse associated with it, for example, the messages and sales pitches by technology retailers and developers (see excerpt from Apple Inc's. p.45). The current ideology that accompanies technology and education (see 2.5.1 and 2.5.2), which has been shaped by the authoritative voices and marketing power of major corporations (see Buckingham *et al*. 2001; Conlon and Simpson, 2003; Selwyn, 2016; Selwyn, Nemorin, Bulfin and Johnson, 2018), may also have influenced their senior managers. Furthermore, recent emphases on teachers and learners use of digital technology in educational policy and professional standards (see GTCS, 2012a&b, Scottish Government, 2009a), may have strengthened those messages and current thinking about technology and schooling - prompting their senior managers to ensure technologies were available, as well as to promote the use of them in order to fulfil existing policy requirements.

Implications

Lastly, the participants' accounts indicated their knowledge and expertise, as well as interest and enthusiasm for technology exceeded that of their senior managers. I believe encouragement by their school leaders, coupled with those personal and

professional reasons described in Chapter 5, such as *duty and responsibility* (5.2.2) and *career advancement* (5.2.4), prompted these participants to assume technology related roles and responsibilities that one might expect their senior managers to have undertaken. For example, organising and *leading professional learning* for colleagues (4.3.2), *involvement in working groups* - in several cases this involved participants instigating and leading those groups (see 4.3.3), as well as *campaigning* and promoting the use of technology across the school via working group initiatives (see 4.4.3). Thus, their senior managers' lack of knowledge and expertise with technology required these teachers to undertake those particular habits and practices with technology, and consequently compounded the time and effort they had to invest in it.

6.2.2 Lack of strategic overview for technology

Limited vision

At the outset of the previous section (see p.149) the importance of schools having a clear vision for technology use was highlighted (see OECD, 2015a). However, evidence indicates that a recurrent lack of strategizing and long-term planning by school leaders in order to realise those visions has been an ongoing issue - particularly in relation to the procurement of technology (see BECTA, 2006; HMIE, 2007; OFSTED, 2011; OECD, 2016; BESA, 2018). Results from this study support those findings with the participants maintaining there had been limited forethought or planning by their senior managers in relation to technology use. In many cases technology was hastened into their schools, as illustrated by Linda's comments on the introduction of a 1 to 1 (one device for each pupil) program at her school:

> It wasn't really done in a way where the staff were trained then the kids were given devices. It was; kids have these devices, let's use them in our lessons.

Linda - 3rd March 2018

All but one of the teachers maintained they were not aware of any overarching, long-term strategy for technology use within their schools. Linda acknowledged the use of technology was included in a whole-school development plan, but she was unaware of any formal, school-wide policies or guidelines in place to support staff within her school. Several participants did, however, highlight their senior managers understood the need for implementing whole-school approaches to technology, and indicated they had begun to consider developing policies to realise those ambitions:

> …senior management has realised now there are lots of people doing bits and bobs and so they are now trying to get a bit more of a structured approach to it. And it's there's certainly something going that way but I would still say in terms of a whole school way of taking IT forward it's not there.

Bill - 24th May 2016

However, like Bill, many participants felt previous attempts to develop and implement such strategy had been haphazard and not thought through. The teachers attributed those failings to their school leaders, citing issues raised in the previous section (see 6.2.1), namely their senior managers not being familiar, proficient or confident using technology:

> …you have to have people in senior management…who have the capability and knowledge and comfort with technology to take that journey. And if that's not in the senior school leaders, then it [technology] will continually be paid lip service.

Charlie - 8th February 2016

Assuming strategic roles

Given their school leaders apparent lack of knowledge and expertise with technology - in contrast to their own understanding, experience, skills, as well as their personal and professional drive to use it (see 5.2), it was perhaps unsurprising to find some participants had assumed roles in which they had responsibility for whole-school strategizing on such matters. For example, Ronnie recounted instigating a meeting with his head teacher, which resulted in setting up a technology working group within the school, which he subsequently led (see 4.3.3). The role he undertook involved, amongst other things, refining the school's mobile phone policy, as well as implementing a 'bring your own device (BYOD)' initiative across the school:

> Ronnie: Yes, I mean I met with the head teacher at the start of the year, and we were quite keen to get like a working group going, so… And I now lead that in the school, a technology kind of working group.
>
> *Me:* *In the whole school?*
>
> Ronnie: Yes. So looking at policies and things like round it as well. A big one is mobile phones, the use of mobile phones in classes. Because currently our policy on that is very strict, very rigid, people should not have a mobile phone out at any point…
>
> …Again, I spoke to the Head Teacher about that as well, and we both agreed actually that bringing your own device is the better way to go when it comes to money with technology. Otherwise you've got an iPad this now, but in another five years' time, that could be out of date again, you're spending all your budget on that.
>
> Ronnie 18th March 2018

This finding was more pronounced in Brian's account. Brian acknowledged the absence of any overarching vision for technology within his school - despite a 1 to 1

program having been in operation for over 4 years: '*...I suppose the confusion here in the school lies with a lack of direction'* (1st February 2016). Discussing his promoted role within the school, namely the responsibility for 1 to 1 learning and teaching with iPads, Brian described issues he faced on assuming the position:

> There's no, there was no criteria of what my job was. My criteria is one-to-one, that's it, that's my heading…One-to-one learning and teaching. And I've set up objectives of what I want to achieve. I think it's skillset, upscaling the staff. I think it's upscaling the…It's all come off my creativity of what I want to do.
>
> Brian - 1st February 2016

Though Brian's senior managers recognised a need for establishing such a role within the school, it seemed they had little knowledge of what it would entail or what the aims and objectives of the post should be. Consequently, Brian was permitted to decide such detail himself. These findings are somewhat in-accord with concerns raised in Chapter 2. Influenced by the *'hubris-driven solutionism'* (Selwyn *et al*. 2018 p.15) associated with technology and schooling, and assumptions that technology is educationally beneficial (Bromley, 1998) the manager's in Brian and Ronnie's schools were prompted to ensure arrangements were in place. However, in Chapter 2 (see 2.5.2) I also highlighted how these messages, promoted by technology corporations, politicians and policy makers, rarely provide details about what the actual problem is (Buckingham, 2007, Gard, 2014). This was apparent in Brian's case where his senior managers were unable to determine explicit responsibilities of the role. Moreover, on undertaking the position, Brian was required to invest time deciding on the aims and remit of the post. Furthermore, the decisions he was permitted to make were arguably

significant as they would impact on both the staff and learners' habits and practices with technology.

Implications

Similar to findings presented previously (see 6.2.1), the absence of overarching policy or guidance afforded participants certain freedoms with technology, as Bill highlighted when discussing current arrangements within his school: *'They* [senior management] *are quite happy, and I haven't got anything imposed on me'* (24th May 2016). Again, those circumstances suited not only their senior managers, but also the teachers themselves who were able to determine what technologies they used, as well as when and how they used it. Furthermore, I contend the lack of strategic overview within their schools fostered some of the *formal* and *informal* habits and practices undertaken by these participants (see fig. 4). With limited direction or guidance provided by their senior management teams these teachers were literally left to their own devices! I believe this prompted them to engage in habits such as *practitioner conversations* (see 4.4.2), to start *exploration and (re)search - online* (see 4.4.4) as well as carrying out the *4-P Process* (see 4.4.5) in order to determine the most appropriate technologies and practices to use in their teaching. Given the increasing growth and progress of technologies that have potential use in PE (Hilvoorde and Koekoek, 2018), finding the most suitable technologies, through the habits and practices described, would likely require a sizeable outlay of time and effort on the teachers' part.

If a formalised, well thought out whole-school approach to technology had been in place within these participants' schools, that contained guidance on what technologies to use, as well as how and when it could be used, these teachers might not have had to invest the same time and effort undertaking many of the practices reported, such as

exploration and (re)search - online (see 4.4.4), in order to find this information. It is perhaps important to revisit findings from Chapter 5 at this point, in particular the notion these participants found engaging in habits and practices, such as *the 4P Process* (4.4.5) and *practitioner conversations* (4.4.2) as enjoyable and rewarding (see 5.2.1); and believed they had professional *duty and responsibility* to do so (5.2.2). The introduction of a formalised whole-school approach would be helpful in supporting those teachers keen to use technology, but have little knowledge and expertise with it. For example, in terms of efficiency and teachers' workload, a whole-school approach would likely draw on best practices and direct staff to the most effective habits and behaviours associated with technology use, as well as specific uses of technologies. Nevertheless, an overarching approach might not suit others, like the teachers in this study who are knowledgeable, proficient and confident using technology. It is conceivable those teachers' habits and practices with technology might be restricted, and less self-directed - something participants in this study valued, if such policies and overviews were in place.

Interrelatedness

At the outset of this chapter I acknowledged the interrelated nature of the underlying factors. So far only two factors have been presented, but associations between them are apparent. For example, the participants senior managers' lack of knowledge and expertise with technology (see 6.2.1) may in part explain the absence of any formalised planning or top-down strategic overviews in relation to technology use within each of their schools. Furthermore, this combination of a lack of planning, knowledge and foresight could explain the occurrence of many of the barriers and challenges widely associated with technology use in schools reported in Chapter 2 (see 2.4), such as,

limited time allocated to learn about technology, and time to implement it in lessons (see 2.4.1); a lack of subject specific professional learning opportunities (see 2.4.2); the failure to provide adequate physical and organisational infrastructure to support technology use (see 2.4.3). For instance, without a level of knowledge, expertise and experience using technology for teaching purposes senior school leaders are unlikely to appreciate and consequently be able to factor for the time it reportedly takes staff to learn how to use it purposefully (see BECTA, 2007; Ertmer *et al.* 2012; OECD, 2015a; Scottish Government, 2015a; Wilson and McKinney, 2012; Weir and Connor, 2009; Palao *et al.* 2015). In the following sections I will re-examine some of the barriers to technology use highlighted in Chapter 2. Furthermore, I will argue those barriers have arisen as a result of senior school managers' lack of knowledge and expertise with technology, the lack of strategic direction for it in schools, and an ongoing emphasis on acquiring technology at the expense of other requirements associated with the implementation of it.

6.2.3 Emphasis on procurement of technology

Over-resourced

When examining this final underlying factor various sub-factors, namely limited technical support, limited provision for professional learning and limited infrastructure within these participants' schools to support the use of technology were developed. After an initial discussion on this factor I will consider each of those sub-factors in turn, and explain how they might have occurred as result of an over emphasis on the procurement of technology.

In Chapter 4 I established the participants believed they were fortunate in terms of resources, in particular the number of devices that were available to them and their pupils:

> The amount of iPads we've got, we're swimming in them. But the difficulty is with all these iPads, is that people jumped on the bandwagon. We've jumped on the bandwagon and bought iPads but nobody's had a realistic think about the architecture and the structure of the school.
>
> Charlie - 8th February 2016

Charlie's remarks indicated this was at the expense of areas he, and other participants, believed were fundamental for effective use of technology, namely the provision of sufficient technical support; ongoing professional learning for staff; as well as appropriate physical and organisational infrastructure to support its use. This finding is consistent with recent results from the NERP survey (see BESA, 2018) that reported 66% of 366 secondary schools in England were ill equipped, in terms of their infrastructure, to support technology use. Additionally, Charlie's comments about his school having *'...jumped on the bandwagon'* reaffirm concerns raised previously about a recurrent lack of strategizing and forethought on such matters (see 6.2.2), as well as Linda's claims about technology being hastened into schools with little prior thought given to what was required to support the use of it (see p.153). Furthermore, these findings broadly support results from previous studies (see BECTA, 2006; Ertmer *et al*. 2012; HMIE, 2005, 2007, OFSTED, 2004), which reported that UK schools were amongst the highest ranked in terms of computer to pupil ratios (OECD, 2016). Some participants even suggested their schools were over-resourced, for example, Charlie's comments about his school *'swimming'* in iPads, and Ronnie's claim that *'...we're almost bursting at the seams in terms what resources we've*

actually got…' (12th May 2016). Thus, Cuban (2001) and Conlon and Simpson's (2003) warnings that technology is often *'oversold and underused'* appears to be valid and relevant nearly two decades on.

In Chapter 1 I outlined how the Scottish Government has been proactive in recent years promoting and supporting the use of technology in schools, for example: the 'National digital learning and teaching strategy for Scotland' (Scottish Government, 2015a and 2016); GLOW (Education Scotland, 2015), as well as the introduction of a national procurement framework for schools and local authorities for purchasing devices and hardware (Scottish Government, 2018a). Therefore, it was somewhat unsurprising to find these participants' schools well-resourced in terms of technology. Though not novel, this finding does support the positive and direct relationship between the procurement of technology and the recurrent launching of related government policies and initiatives reported previously in the literature (Ertmer *et al.* 2012).

Poor decision making

Despite their knowledge, expertise and experience with technology, these participants had limited influence over whole-school decisions about the technologies their schools acquired. This finding was notable in the narratives of those with formal responsibilities for technology, such as Brian, as well those actively involved in their school's technology working groups, namely Ronnie, Linda and Keith. Even though their senior and line managers lacked experience, as well as a knowledge and expertise with technology (see 6.2.1) these participants revealed they still made decisions on such matters, for example what devices and platforms should be acquired and used. Brian's account of his senior management's decision to invest in hundreds of Android

tablet PCs, in order to implement a 1 to 1 program at his school, serves to highlight problems that arise as result:

> …the Android device wasn't too compatible with what we wanted to do with a lot of the apps...We also had staff who had an iPad, and trying to run a lesson with an Android. So it just didn't work. So there was money spent there, potentially wasted…
>
> (Brian 1st February 2016).

Brian recounted how the decision was criticised by subject staff as it became apparent the functionality they required was not available on that particular platform. Consequently, he claimed: *'...we've got hundreds of Androids that really have fit for no purpose...'* (1st February 2016). Though not to the same extent as Brian's school, Mick described reasons for his PE department investing in android tablet PCs over iPads, claiming his principal teacher was *'...not a big fan of Apple, which limits a lot of the apps that you can use'*. Mick went onto highlight that despite his PE department possessing a set of 13 android tablets he was *'...yet to see anyone using ICT other than me...'* (5th February 2016). These findings broadly support results from reviews undertaken by BECTA (2006) and HMIE (2007) where schools were often found to have acquired technology with inadequate specifications, and consequently it remained unused.

Resourceful

In terms of their subject area all teachers believed their PE departments were well resourced - particularly in relation to the number of devices available. This finding is contrary to previous results which suggest PE has been regularly overlooked in favour of other curriculum areas when it came to funding for technology (Tearle and Golder,

2008; Miller, 2012). Though well resourced, participants indicated their PE colleagues did not use the technology to the extent they themselves did. Though, in accord with Cengiz's (2015) findings, participants did acknowledge colleagues within their departments were becoming increasingly aware of technology use in their subject, and more enthusiastic about its potential, as illustrated by Mick:

> To an extent yes, so I'd been using it a lot and the PT [Name Removed] asked me to do a CPD because, I was coming back and saying I've just done this, I've just done that…and he was like right we need to see it. So we did the CPD and it was all very, very positive, you know all the staff did use it for a short period straight after, when they were, you know had the wee buzz, so they did use it.
>
> Mick 20th May 2016

Provision for technology in the participants' departments could be explained, in part, by those government funded initiatives and programmes highlighted elsewhere in this section (see p.161). However, consistent with previous findings (see Eberline and Richards, 2013; Chambers *et al.* 2017), these participants proved to be proactive and resourceful in terms of acquiring technology. For example, with regards to internal funding Bill claimed : *'...I am pushy to try and get the technology…I kind of go and knock on the Head Teacher's door and probably get a 'aw not you again'...'* (24th May 2016). Bill, like several other participants, also described how he actively sought out external funding to secure technology for his department, in this case a set of FitBit personal activity trackers: *'So I then put a bid in to Education Scotland right at the start of the first round of funding'* (26th February 2016). Finally, Ronnie recounted how a bank of iPads *'...seemed to appear...'* in his department when his former principal

teacher of PE[9] arrived at the school - despite there not being funding available (Ronnie - 12th May 2016).

In the following section's I will consider the implications of this emphasis on procuring technology in the teachers' schools, and how it subsequently influenced their *weighted investment* with it. Before proceeding it is important, however, to consider how these circumstances might have arisen. Earlier in this section I highlighted that these participants were not directly involved in whole-school decisions about what technology should be acquired, with such decisions reportedly taken by senior managers (see p.161). Given their school leaders' lack of knowledge and expertise with technology (see 6.2.1), I question their capacity and suitability to make such decisions. Reiterating my line of reason from earlier in this chapter (see 6.2.1), I believe with little understanding and experience to draw on these teachers senior managers were more susceptible to the power and control exerted by the major corporations that design and supply technologies used in schools, as well as politicians and educational policy makers that advocate its use (Conlon and Simpson, 2003; Sewlyn *et al*. 2018). This provides a plausible explanation for the manner in which technology was hastened into these teachers school's (see Linda remarks 6.2.2 p.153), as well as the impulsive purchase of 100's of android tablets by Brian's school that subsequently turned out be inadequate for the needs of the staff (p.162).

6.2.4 Limited technical support

An initial sub-factor that I believe stemmed from an emphasis on the procurement of technology in these participants' schools was a lack of adequate technical support. In

[9] The teacher , who has subsequently moved onto another post, happened to be Charlie another participant involved in my study.

Chapter 4 I established all participants regularly undertook technical duties with respect to their school and departments technology (see 4.4.1). This was over and above their normal teaching responsibilities and obligations, and despite eight out of the nine teachers indicating their schools currently had some form of technical support in place (see p.111-112). Consistent with previous findings (see BECTA, 2006; HMIE, 2007, OFSTED, 2004; Tearle and Golder, 2008), support services available in these teachers' schools appeared inadequate, making it challenging for participants to sustain their use of technology. However, similar to the findings reported by Davidson and McQueen (2006) participants in this study were able to maintain their use of technology by undertaking some of those duties that should have been carried out by their technical services

Overlooking and underestimating

It is widely recognised teachers' use of technology is largely dependent on the availability of adequate technical support services (HMIE, 2007; Judge and O'Bannon, 2007; OFSTED, 2004; Wilson and McKinney, 2012). However, it emerged the participants' schools and local authorities had either failed to recognise or had underestimated the importance of providing sufficient levels of technical support. The majority of participants' maintained support was available in their schools, though in many cases their school leaders had been reactive as opposed to proactive on this front - not ensuring it was in place prior to acquiring the technology. There are several likely explanations for this, such as budget constraints, and initiatives, for example NOF (2000) and the *Laptops for Teachers* scheme (see BBC Education 2002 January 9th) restricting what funding could be spent on, namely not on salary costs for technicians. However, I argue the teachers' schools and authorities had overlooked the significance

of providing technical support, only addressing the issue once the technology itself was in place. This idea was most pronounced in Brian and Linda's accounts, both of whom worked in schools that operated a 1 device to 1 pupil programme. Despite those programmes having been in operation for a period of time - 4 years in Brian's case (having been first implemented in 2012), both teachers indicated their school's had only recently employed a dedicated technician to support their programmes:

> …what we've also done, at the start of the year, was the school employed an ICT technician full-time and he has been great…So, the technician, they've invested a lot of money in that. So that's a big supporting foundation. And he's been good.
>
> Brian - 16th May 2016

Both teachers spoke positively about the services available to them, yet Brian and Linda maintained they still regularly undertook various technical duties related to their iPad's, highlighting the inadequacy of the support.

Consistent with previous findings, which indicate inconsistencies in technical provision for technology in schools (see BECTA, 2006; HMIE, 2007), the participants' experiences and opinions of their support services were varied. Like Brian and Linda, other teachers had also established good relationships with their support staff, and spoke favourably about the assistance they offered: *'...we've got fantastic tech support in this school and they're great'* (Bill - 24th May 2016), despite still having to undertake some of those duties themselves. However, some were less complimentary about the services available in their schools. Ronnie was critical of the level of support he received, claiming this was an authority issue as opposed to the school, with his technician having responsibility for all secondary schools in his local

authority. From the teachers' accounts it was evident the level of technical support available differed from school to school, as well as authority to authority. Irrespective of the level of support all of them continued to undertake technical type duties in order to maintain their own, as well as colleagues, use of technology.

Inconsistent and insufficient

Despite technical support being available in these teachers' schools, several of them (Bill, Charlie and Ronnie), felt that it was insufficient, or as Bill put it *'...a limited resource'* (26th February 2016). In particular, they believed their technicians did not always possess the expertise they expected and required. Bill, for example, claimed to be more knowledgeable about some platforms and devices than his school's technician: *'I probably know more about iPads than they* [technicians] *do...'* (Bill - 26th February 2016). Additionally, on occasion the staff and technical support staff held different views about the merits of particular devices, as illustrated by Keith: *'Our technician last year was pretty good with them* [iPads]. *Our new technician's not so Apple crazy'* (Keith - 24th February 2016). The teachers also maintained the level of support available was insufficient, in as much as the demands placed on their technicians exceeded their capacity. This resulted in participants becoming dissatisfied as requests, even for relatively straightforward tasks, took too long to complete. Consequently the teachers often took it upon themselves to do the work:

> I could say to them, I need this app across all my iPads and they say that's fine, we'll definitely do it for you but it's going to be two weeks' time because I've got this list of jobs to get through and I'm saying, well, I actually need it for next week. So I'll just do it myself.
>
> Bill - 26th February 2016

These findings somewhat reflect results from Davidson and McQueen's (2006) study where the absence of technical support prompted teachers to undertake such duties and acquire the relevant technical knowledge and skills that allowed them to maintain their use of it.

In Chapter 4 I established the technical duties undertaken by the teachers extended beyond their own personal needs, with some providing advice and support on such matters to their colleagues (see 4.3.2). Given the status participants had acquired, with respect to technology, it was perhaps unsurprising they were approached by other staff for help. Though, as Charlie points out in the excerpt below, carrying out such tasks further increased the amount of time and effort he was devoting to technology. Charlie like many of the other teachers apportioned the blame for inadequate technical services in his school to his senior managers citing factors discussed elsewhere in this chapter (see 6.2.2). In addition, Charlie's remarks again portray the interrelated nature of these underlying factors, namely a lack of knowledge and foresight from senior managers, the absence of a strategic overview for technology in the school, which led to insufficient levels of technical support being provided:

> …and this goes back to the senior leadership in the school, if there is no strategic leadership and there's no strategic plan…You can have 100 staff going to that same gatekeeper and it's exactly the problems that that creates for their time, for their professionalism…And it becomes, it gets people, pardon my French again, but people get pissed off.
>
> Charlie - 13th May 2016

6.2.5 Limited provision for professional learning and development

Importance and dissatisfaction

Findings in this second sub-section support a view that ongoing professional development is a key factor in teachers' effective use of technology (see Casey *et al.* 2017b; Judge and O'Bannon, 2007; Enright *et al.* 2017; Levent-Ince *et al.* 2006; Thomas and Stratton, 2006). Many of the *formal* and *informal* habits and practices undertaken by participants were specific to or associated with professional development, for example: *engaging in professional learning* (4.3.1); *practitioner conversations* (4.4.2); *exploration and (re)search - online* (4.4.4); as well as *the 4-P process* (4.4.5). The importance these teachers placed on their own professional learning was apparent in the time and effort they devoted to those habits and practices. Furthermore, their narratives indicated this investment had been long-term and was seemingly ongoing (see Brian and Bill's comments 4.4.4). Moreover, this investment extended beyond their own professional development with a number of participants also involved in *leading professional learning* for colleagues (see 4.3.2), providing further evidence of the value these participants placed on it.

Despite their enthusiasm and commitment towards professional learning, many of the participants bemoaned the lack of meaningful development opportunities available, as typified by Charlie:

> …the good CPD actually just now is hard to find still. From my perspective, looking at it, there's maybe two or three people that I'd like to go and listen to, see and work with.
>
> Charlie - 8th February 2016

The teachers were also frustrated at the lack of professional learning opportunities specific to their subject area: *'...there's CPD up here, but I've never really seen anything on ICT or in PE specific CPD…'* (Shirley - 29th February 2016). The PE Geek was frequently mentioned in their narratives in relation to professional learning, suggesting he was a main protagonist and provider in this area. The appeal and popularity of the PE Geek workshops and other resources he produced was indicative of the lack of availability of meaningful professional learning in this particular area, and arguably supported the participants' claims.

Not only were these participants dissatisfied with a lack of subject related learning opportunities, they also raised concerns with the in-house events and training provided by their schools and local authorities. The teachers claimed training was often too generic and pitched at an elementary level:

> It's quite basic ones, but again, obviously for teachers who aren't familiar with using ICT it's beneficial for them. But for I'd say our department are quite... We're not bad with ICT so I think for people who know a bit about it, it doesn't really... Isn't much benefit to us.
>
> Faye - 11th May 2016

Faye's concerns were supported by Linda and the other participants. Despite being positive about the amount of provision at her school: *'...they've done a lot of Office CPD session…Yes three hour session on in-service day and then we had a two hour session within school…'* (Linda - 31st May 2016), Linda acknowledged the content covered was too rudimentary: *'I think for me I knew most of it already, I'd done similar stuff in my probation year…'* (Linda - 31st May 2016). Though, it is important to remember these teachers were not representative of the PE profession in terms of their

knowledge, expertise and confidence using technology. Though the professional learning available within their schools was not suitable for them, it may have been appropriate for many of their colleagues. Consequently, external providers perhaps need to offer a suite of professional development programs or guidelines that cater for those practitioners with advanced knowledge and competence with technology. Lastly, it is comprehensible the absence of more advanced training and development opportunities, as well as those personal and professional reasons described in Chapter 5 (see 5.2), prompted these participants to seek out alternative ways to develop their knowledge and expertise that were more suited to their needs.

Opportunists

Participants were opportunistic in relation to their own professional learning with technology. For example, Linda recounted how she opted onto her school's technology working group, seeing it as a chance to further develop her knowledge and expertise by learning from colleagues in other subject areas who also used it (Linda - 3rd March 2016). In a similar fashion Ronnie recounted how he used local and national CPD events as an opportunity to engage in *practitioner conversations* (4.4.2), suggesting these were often more valuable than the content covered in the events or workshops themselves:

> Yes, well I was gutted because I got an e-mail back saying there's only one other person going. So the main point I'm going…was to go and speak to people and try and get some ideas…And it's the same with technology, it's just kind of throwing ideas out there and speaking to people. And I think, the more you share with other people about what's worked well for you, the more you get back in return.
>
> Ronnie - 18th March 2016

Many of the concerns highlighted by these participants, with respect to professional learning in this area, are consistent with those reported in the literature, namely the irrelevance of generic courses and stand-alone workshops (Franklin *et al*. 2005, Koehler and Mishra, 2009; Orlando, 2014); a greater need for subject and context specific professional learning opportunities (Hew and Brush, 2007; OFSTED, 2011); and training that is more personalized to their own needs (Ertmer *et al*. 2012; Ottenbriech-Leftwich *et al.* 2010). I contend these issues had implications for the participants, with limited availability and arrangements for professional leaning prompting them to seek out alternative ways to develop their knowledge and expertise using technology. Given the participants' commitment towards their own professional learning and development (see 5.2.2), it was unsurprising they sought alternate ways to enhance their understanding and skills with technology, such as engaging in *practitioner conversations* (4.4.2), *exploration and (re)search - online* (4.4.4), as well as undertaking the *4P Process* (4.4.5). I am not claiming their habits and practices are novel or unique, though aspects of them are consistent with Ertmer's *et al.* (2012) recommendations for more purposeful professional learning in this area, namely conducted in the work setting, collaborative in nature, and the involvement of technology in the process (e.g. social media platforms, blog and Wiki's). There were also similarities between the self-directed practices described by the participants in this study and those reported by Calderon *et al.* (2017) and Gleddie *et al.* (2017). For example, a frequent use of social media to engage in *practitioner conversations* (see 4.4.2), and *exploration and (re)search - online* (see 4.4.4) to find new technologies, as well as undertaking *the 4P Process* (see 4.4.5) to determine the most appropriate approaches and contexts to use technology in.

Similar to findings reported earlier in relation to technical support (see 6.2.4), it seemed the participants' schools and councils had again overlooked the importance of investing in relevant and ongoing staff development and training to support their use of technology. Once more, the schools appeared reactive to staff development needs, with training and workshops arranged after the technology had been acquired and was being used - or not being used in many cases. Linda's earlier comments (p.153), which are representative of other participants' experiences, capture the lack of forethought on such matters: *'It wasn't really done in a way where the staff were trained then the kids were given devices. It was; kids have these devices, let's use them in our lessons.'* (3rd March 2016). Though I suggest these circumstances resulted from an emphasis on procurement of technology, it is likely a combination of underlying factors, such as their *managers' lack of knowledge and expertise with technology* (6.2.1), as well as the absence of any long-term planning and the implementation of a strategic overview for technology use (see 6.2.2) that led to this limited provision for professional learning and training.

Informal practices

Though it was never my intention to determine which habits and practices in the framework were most beneficial to these participants (see fig. 4), there was definite sense they valued the more *informal* practices when it came to their own professional learning and development (see 4.4). For example, the importance placed on engaging in *practitioner conversations* (see 4.4.2) was evident in Ronnie's comments elsewhere in this section (see p.171). Furthermore, the value attached to other *informal* practices was apparent when participants discussed their *exploration and (re)search - online* (see 4.4.4), as illustrated by Charlie:

> To be honest, social media is the best places… I mean Twitter's fantastic for just picking up stuff and having a think, looking at it, reading it, following your nose. And I use… Twitter's my main one for CPD, to be honest. I'll scout about and, you know, probably pick out one article, read it and then it will lead you on to another before you know it you've spent 30 minutes reading and it's got you thinking...
>
> Charlie 8th February 2016

The value attached to *informal* practices, specifically in relation to professional learning, is consistent with previous findings, for example, the use of social media to discuss and share practices with other colleagues (see Calderon *et al.* 2017; Gleddie *et al.* 2017). Those practices also afforded these participants the flexibility that traditional professional learning opportunities, such as workshops and face-to-face training did not. For instance, these teachers were able to engage in online dialogue with other practitioners (see 4.4.2) or undertake internet searches as and when necessary, and at times that suited them - such as in the evenings, at weekends, and even during school hours (see 4.4.4). These findings are also in accord with Calderon *et al.* (2017) and Gleddie's *et al.* (2017) results, with both drawing attention to the adaptable nature of those practices. Thus, the participants in this study were able to develop themselves in a responsive and flexible way utilising features inherent in digital technologies, namely the ability to connect, collaborate , and personalize their learning to meet their specific needs (see Pritchett *et al.* 2013). Furthermore, it seemed they undertook those practices of their own volition - without direction or support from their school. Though, features of those practices are in-line with recommendations for professional learning in relation to teachers' technology use (see Hew and Brush, 2007; Koehler and Mishra, 2009; Levent-Ince *et al.* 2006; Mishra and Koehler 2006; Thomas and Stratton, 2006).

Finally, considering those habits and practices in the *weighted investment* framework related to professional learning (see fig. 4) in collective terms, it was apparent these teachers spent a sizeable time and effort engaged in their own development. Moreover, like the practitioners in Casey's collection of pedagogical cases each of the teachers in this study had also undertaken *'an intensely personal and emotional learning journey'* (Casey *et al*. 2017a p.249), with respect to their use of technology. In addition, their accounts supported Fletcher's *et al.* (2017) findings in as much as these participants understood the need to continue devoting time and effort in these practices given the transient nature of technology, and ongoing advancement in the field. Despite their investment being sizeable and ongoing, these teachers valued the time and effort they spent undertaking those practices, and indicated it was integral to their use of technology. For example, Charlie claimed it allowed him to develop a *'depth'* of knowledge, as well as having a positive *'impact'* on what he was able to do with technology (Charlie 8th February 2016).

6.2.6 Limited physical and organisational infrastructure

Physical infrastructure

In terms of physical infrastructure, eight out of nine participants criticised their schools wireless network (WiFi), in particular its strength and speed, as well as lack of signal in their practical teaching areas. This frustrated the teachers, as it limited their ablity to use their technology: *'It just seems silly having so much resources and right now if we want to use that* [iPad] *in a practical setting you need to say right, so and so, you need to go out to the corridor…'* (Ronnie 12th May 2016). This finding is consistent with the broader literature which found most schools in Scotland had access to broadband internet by mid-2000, but reported ongoing issues with the efficiency and

dependability of it (HMIE, 2007). The results from the present study also reflect findings in PE specific literature which indicate the subject area has often been poorly served with regards WiFi connectivity (see BECTA, 2005). Though, there was little evidence at the time to suggest the recent SWAN initiative (see 1.3) (Education Scotland, 2015) had addressed issues concerning internet connectivity in these teachers' schools. However, it was evident many of the participants had been proactive in finding ways to address the WiFi related issues they encountered. For example, Mick described acquiring a portable device that allowed him to set up his own independent wireless network in the games hall or on the astro-turf, permitting more constructive use of his schools tablet PCs (5th February 2016). Brian explained how he overcame WiFi issues by using the AirDrop feature on iPads as an alternative way to connect devices in order to transfer data between himself and the pupils (1st February 2016). Finally, Charlie described acquiring two unused routers and setting up his own network, independent to the school's, which permitted him to link his departmental iPads to a plasma screen TV allowing pupils to review and analyse their practical performances (8th February 2016). Although not explicit within their accounts it is likely these teachers were able to accomplish these workarounds as a result of the level of technical skill and knowledge acquired through undertaking many of the *formal* and *informal* habits presented in Chapter 4 (see fig. 4).

The notion of these participants being proactive and innovative with technology was also evident in their practical teaching spaces. In contrast to previous findings that suggest the age and state of school PE facilities are often problematic when it comes to using technology (see BECTA, 2005; Kretschmann, 2015b; Pyle and Esslinger, 2014; Thomas and Stratton, 2006), I observed technology that was integrated into the

participants' teaching areas in creative and pragmatic ways, as illustrated in the following field journal entry after my initial visit to Bill's school:

> Bill met me at the reception area and took me to the PE block and without prompting took me to a class that was underway to show me how they use ICT in their lessons. We went in to a lesson that looked to be a single sex boy's class (S2 or S3?). The hall was an old fashioned/traditional gym hall, which seemed at odds with the technology being used…
>
> A projector was fitted onto the ceiling and was projecting a movie on to the gym hall wall…It was a fitness app. (didn't get the name) that had a workout that all the boys were following on their bike. The movie footage had instructions and there were timings overlayed on the footage that the boys were working to. Each bank of 4 bikes also had an ipad in front of them on the floor displaying their heart rates. Each pupil was wearing a Bluetooth polar HR monitor that linked up to their respective ipad.
>
> Field notes - 26th February 2016

Organisational infrastructure

Many participants highlighted concerns about discrete policies and processes in place within their schools and authorities relating to specific uses of technology, which they were expected to adhere to. Bill, Keith, Linda, Mick and Ronnie indicated their school's had explicit rules for particular devices and applications, for example, policies that governed the use (or non-use) of personal mobile phones and other handheld devices during class time. The shortcomings of those policies were all too apparent to these teachers, namely they were too narrow, and focused on specific devices, applications, platforms or websites. Moreover, the teachers recognised that the policies often restrained the use of technology, as opposed to promoting its use: *'...it* [school policy] *is about not using mobile phones…It's about restriction and where they can be used and so it is pretty antiquated'* (Bill - 24th May 2016).

Some participants also indicated their schools and local authorities had established protocols for other aspects relating to teachers' use of technology, for example, procedures for purchasing new applications and software for school devices. Again, the participants reported concerns, maintaining the processes in place were too convoluted. Similar to the earlier findings in relation to WiFi issues (p.176), many of these teachers had been proactive in finding ways to circumvent their schools or authorities protocols, as exemplified by Bill: *'...I'm pulled into the constraints of operating within the council framework and system. Though I'm not averse to stepping outside that and finding ways round it as well'* (Bill - 26th February 2016).

Similar issues were reported when participants described procedures in place for updating operating systems and downloading new software on school devices. The teachers described having to be creative, as well as sometimes having to flout the rules, in order to address the procedural issues they encountered. For example, Bill described devising an alternative, unauthorised way of purchasing and downloading applications onto his school iPads:

> If I was allowed to do it the way I wanted to, it would be much more straightforward. The authority has a system called AirWatch…I can push out an app to all my devices but it's hit or miss and it goes to some and not to others and it's really flaky…
>
> Bill - 26th February 2016

Findings in this section support those presented elsewhere in the chapter, namely participants being determined to use technology in their practice, and actively seeking out solutions - often coming up with innovative ways to overcome the problems encountered. These results are somewhat consistent with ideas presented in the

literature, most notably claims by Eberline and Richards (2013) that PE teachers need to be creative when it comes to technology. Though the author's discuss the need for PE practitioners to be resourceful and innovative in relation to securing funding and acquiring resources, the evidence presented elsewhere in this section in relation to how these participants overcame organisational constraints indicates this idea of being creative applies more widely to other matters concerning technology use in PE. This idea was further exemplified by these participants when they described finding ways and time to develop their knowledge and abilities, such as using social media to engage in *practitioner conversations* (4.4.2) which allowed them to connect with like-minded practitioners beyond the confines of their department and school. It also meant they were able to engage in such dialogue more frequently, as well as affording them flexibility to do it at times that suited them.

6.2.7 Underlying factors - final thoughts

This chapter focused on a series of underlying factors developed from the participants' accounts in an attempt to further understand and explain their *weighted investment* in technology (see fig. 4). Though, it is likely their investment was influenced by a combination of those personal and professional motives reported in Chapter 5 (see 5.2), and the underlying factors described here. In order to try and portray the interrelated nature of these teachers' motives for using technology, the underlying issues they confronted, and the collective impact they had on their habits and practices with technology, I will examine the following excerpt from Bill's narrative:

> That's probably why my staff are adopting this technology because I kind of do a lot of the stuff behind the scenes. So

> it's just there and it works for them and to tell you the truth,
> if it didn't work, they wouldn't be picking it up and using it.
>
> Bill - 26th February 2016

Bill, like all of the participants, indicated he frequently undertook technical duties to ensure his departmental iPads remained in working order (see 4.4.1) - I contend he was prompted to do so as a result of their being inadequate technical support within his school (see 6.2.4). At the same time, Bill was possibly driven by a sense of professional *duty and responsibility* (5.2.2), as well as his personal *values and beliefs* (5.2.3) in relation to what technology adds to the learning and teaching that occurs in his, as well as his colleagues lessons. On balance, it is likely that all three - the one underlying factor (insufficient technical support) and two personal motives (his own beliefs about technology and professional obligation to use it) influenced to varying degrees Bill's decision to undertake the technical duties.

At the beginning of this chapter and the previous one - Chapter 5, I suggested some of the motives and factors were likely to be more influential than others in terms of their impact on these teachers' habits and practices with technology. Though no attempt was made to distinguish which had the most influence, the personal professional reasons for why they invested time and energy in technology were predominant in one sense. I highlighted this idea at the end of the previous chapter (see 5.2.5), believing the motives reported by participants, namely e*njoyment and reward* (5.2.1), *duty and responsibility* (5.2.2), *values and beliefs* (5.2.3), as well as *career advancement* (5.2.3) affected their ability to be impartial when evaluating the extent of their *weighted investment* in technology. Furthermore, I contend the highly personal and professional nature of those reasons somehow masked the impact the underlying factors presented

in this chapter had on the time and effort these participants were devoting to technology. Despite them being alert to the various underlying factors these teachers were unaware of how they had influenced their day-to-day habits and practices with technology.

Bringing these findings and ideas together, these teachers displayed limited capacity to understand and scrutinise the technology they used from a broader, critical perspective, and consequently were unable to realise the power and control it has, or at least those who advocate its use have, over their habits and practices with it. The participants' capacity to evaluate and critique the technologies they did or did not use was apparent on one level - when undertaking *exploration and (re)search - online* (see 4.4.4), as well as throughout each stage of the *4P Process* (see 4.4.5). However, revisiting Larrivee's (2008) framework for assessing teachers' reflective capacities (see p.126), it was apparent participants were appraising technologies at the lower end of his frame, and were focussing predominantly on matters concerning the *'...functions, actions or skills...'*, as well as *'...the theory and rationale...'* that underpinned the technologies they used (Larrivee, 2008 p.342). The teachers' reflections rarely extended to the higher-order levels in the framework that would involve them considering the *'...ethical, social and political consequences...'* (Larrivee, 2008 p.342) of the technologies they used. Although Charlie believed he was able to extricate himself during *the 4P Process* - in his words *'step back and evaluate'* (see p.126) the technologies he used, it seems he and the others needed to step back further. However, it is debatable whether this would enable him and the others to realise the impact the various underlying factors were having on their *weighted investment*. Moreover, I contend in order for these participants to operate at

the upper level of Larrivee's framework, would require some initial guidance and support. I believe the personal and professional motives for using technology described in the previous chapter (see 5.2) hindered their ability to reflect on broader issues concerning technology use, and recognise the impact the underlying factors had on their practice. Revisiting the wider, ideological matters concerning technology and schooling covered in Chapter 2, in particular notions about power and control (see 2.5.3), and hegemony provide a plausible explanation for these findings. In Chapter 2 I highlighted that an ideology has developed that associate's technology use with perceptions of a quality education. Moreover, the omnipresence of technology in schools has resulted in it becoming an unexceptional, everyday feature of contemporary schooling (Selwyn, 2014; 2016; Selwyn *et al*. 2018). I believe this was the case in the participants' schools where technology was readily available (see 6.2.3). As a consequence of technology use becoming commonplace in schools, based on an assumption that it is educationally beneficial, it now receives little attention or debate (Selwyn, 2014). Moreover, when it is examined and scrutinised, Selwyn (2014) claims that attention is often paid to practical and technical features, and how it can be utilised more effectively. Selwyn's (2014) claims are consistent with findings from these participants' accounts, for example, the level of scrutiny evident when participants undertake *the 4P process* (see 4.4.5).

Finally, in Chapter 2 I also drew attention to arrangements that have led to technology becoming a background feature in schools. In particular I highlighted the main protagonists involved, namely the major technology companies such as Apple Inc. and Microsoft, as well as the politicians and educational policy makers, and how they are able to exert power and control in order to further their own economic and corporate

interests and maintain their positions of authority (see 2.5.3). Furthermore, I highlighted how those arrangements have enabled technology use in schools to avoid any sustained critical analysis, to the benefit of the providers and politicians (Selwyn *et al*. 2018). I contend it is those arrangements and related matters these participants need to become aware of, and be able to scrutinise, in order that they can begin to address the underlying factors presented in this chapter.

Chapter 7 Conclusion

7.1 Overview

This chapter will serve two functions. Firstly, I will consolidate key findings from the study, highlighting their significance in terms of impact on these teachers' practices. Mindful of the wider aims and purpose of an Educational Doctorate, namely to blend '*...practical wisdom and professional knowledge to identify, frame and solve problems of practice...*' (Zambo and Zambo, 2013 p.1), I will also present a series of general recommendations applicable to both in and pre-service practitioners, before concluding with a discussion on possible directions for future research.

7.2 Key finding 1 - 'time and effort'

Results from this study support the broad notion by Fullan (1999) and reinforced more recently by others (see Casey and Dyson, 2009; Casey and Macphail, 2018), that implementing new pedagogical practices in PE are both *'time-consuming and highly labour intensive'* (Casey and Dyson, 2009 p.175). In Chapter 4 I presented the *weighted investment* framework developed from these participants' accounts (see fig. 4). The concept of *weighted investment* encompassed a series of *formal* and *informal* habits and practices reportedly undertaken by these teachers (see 4.2.2), and provided an indication of the extent of their investment in technology. Those practices enabled these participants to develop their knowledge and expertise with technology, for example, *engaging in professional learning* (4.3.1), as well as sustain their use of it, for example, undertaking *technical duties* (4.4.1). The teachers involved in this study also invested time and effort in practices that promoted the use of technologies, for example, *leading professional learning* (4.3.2) and *campaigning* for its use amongst colleagues (4.4.3). Analysis of the participants' narratives revealed that all devoted

sizable amounts of time and effort engaging in those habits and practices associated with technology use (see fig. 4). This was most notable when these teachers described discrete practices undertaken, for example, in Chapter 5 when Mick discussed *exploration and (re)search* - both *online* (4.4.5) and through the *4P Process* (4.4.5), and claimed to: *'...have put a lot of hours into the research that I've done...'* (5th February 2016). Yet, there was a sense participants were not fully aware of the extent of their investment, namely they never considered their habits and practices in cumulative terms - a finding I will revisit and discuss further in a subsequent section (see 7.6).

Finally, it was evident these participants perceived their *weighted investment* in technology in positive terms, claiming the time and effort spent on those habits and practices was a determining factor in their ability to use it confidently, and in more purposeful ways within their practice. This was illustrated by Charlie in Chapter 5 when describing the time and effort he devoted: '*...had a depth and impact on what I can now do with tech'* (8th February 2016). Also, these teachers believed an investment of time and energy was an integral feature of using technology - an idea exemplified by Charlie when discussing how he supported colleagues to use it: *'...I need to give you the time to make the mistake and I need you to go away and go oh, right, so what if I did it that way?'* (13th May 2016).

Recommendation(s) 1

It is important practitioners interested in involving technology in their practice understand a sizeable investment of time and effort is required on their part in order to use it effectually. Participants in this study believed such investment was fundamental to developing their knowledge and expertise with technology, as well as their

confidence in using it. Thus, it is an aspect teachers' keen to involve technology in their practice should not try to circumvent. It is also important those practitioners understand an ongoing investment is likely given continuing advancements, and the fast moving nature of technology. In addition, professional learning and training for teachers, as well as guidelines and learning materials focused on the use of technology require a change in emphasis from what technologies to use, how to use them and for what purpose, to also inform practitioners about the time and effort required. In addition, professional learning and training should highlight specific habits and practices, such as those presented in this study (see fig. 4) that teachers might consider or be required to undertake - an idea I will revisit and discuss further in a following section (see 7.3).

Finally, given a *weighted investment* is deemed necessary for effectual use of technology, it is important senior managers and school leaders, as well as politicians and policy makers with responsibilities for education and technology are also made aware of its significance. For example, if implementing technology initiatives, senior leaders with responsibilities for timetabling and management of staff workloads need to ensure sufficient time is made available within contracted hours to allow staff to undertake those practices reported in the *weighted investment* framework (see fig. 4) - as opposed to leaving them to engage in those habits and activities in their own time. Also, along with national and local initiatives and programs to promote and support the use of technology in schools that focus on acquiring technologies, for example, the national procurement framework (Scottish Government, 2018a), or developing appropriate physical infrastructure, for example, the SWAN program to improve internet connectivity (Education Scotland, 2015), governments and local educational

authorities should look to develop and promote initiatives focused on creating space and time for practitioners to develop their knowledge, skills and confidence teaching with it.

7.3 Key finding 2 - 'Informal practices'

In the *weighted investment* framework presented in Chapter 4 (see fig. 4), I make a distinction between practices that are *formal* in nature and those that are *informal* (see 4.2.2). At the outset it was not my intention to rank and order the habits and practices in the framework in terms of their perceived value to the participants. However, as my analysis developed it became increasingly evident these teachers valued and consequently devoted more time and effort to those *informal,* often unseen practices, namely: undertaking *technical duties* (4.4.1); *engaging in practitioner conversations* (4.4.4); *campaigning* for its use (4.4.3); as well as *exploration and (re)search* both *online* (4.4.4) and through the *4P Process* (4.4.5). In most cases they undertook those practices of their own volition, without direction or support from senior managers and colleagues. Moreover, those *informal* habits appeared important in sustaining their use of technology. For example, undertaking technical duties, such as regularly updating latest versions of software onto departmental iPads to ensure they were equipped and ready for use (see 4.4.1). Furthermore, many *informal* practices appeared important in developing the teachers' knowledge and expertise with technology. For example, engaging in *practitioner conversations* (4.4.2), and *exploration and (re)search - online* (4.4.4) as well as undertaking the *4P Process* (4.4.5). Despite lack of guidance or assistance many *informal* practices undertaken, with respect to the teachers learning and development, were consistent with features recommended in the literature, namely that training should be tailored to their needs and the specifics of their subject, as well

as the contexts in which they practice (Hew and Brush, 2007; OFSTED, 2011). In addition, these participants involved the technologies they used in their teaching for their own learning and development, for example, the use of social media, such as Twitter, to connect and converse with other practitioners. This afforded the teachers flexibility to engage in many of those *informal* practices as and when it suited: *'...a lot of my CPD is actually is done in my own time online, watching videos in forums, on Twitter…seeing what works. Doing that rather than going to formalised courses'* (Bill - 24th May 2016).

Recommendation(s) 2

This key finding raises important questions about the nature of professional learning in relation to teachers' use of technology - specifically for learning and teaching purposes, as well as requirements to sustain their use of it. In particular, there are suggestions for what training and development in this area should focus on, as well as the teacher's role in the process. Given the reported benefits of the *informal* habits and practices undertaken (see 6.2.4, 6.2.5 and 6.2.6), there is an argument for reshaping and reconceptualising aspects of teachers' learning in relation to technology use. I contend many of the habits and practices undertaken by these participants indicated a shift away from more traditional modes of professional learning, such as stand-alone, face-to-face workshops and events. Furthermore, many features inherent to the *informal* habits undertaken should look to be incorporated into future professional development and training opportunities. Those features include training and learning being undertaken on an ongoing basis, being more obtainable, on-site, and flexible to suit the specific needs of teachers and the contexts in which they practice (see 6.2.5).

In accord with recommendations in the previous section (see 7.2.1), I believe it is important practitioners, particularly those keen to involve technology in their practice or those in the early stages of introducing it, are made aware of those habits and practices represented in the *weighted investment* framework (see fig. 4). I argue the *informal* practices reported by these participants have greater potential than the *formal* habits in terms of developing teachers' knowledge, confidence and expertise with technology. However, in danger of contradicting these findings, traditional modes of professional learning may provide an opportunity, initially at least, to increase teachers' awareness of those *informal* habits and practices, such as using social media to collaborate and increase the frequency of *practitioner conversations* (4.4.2), learning about and how to undertake *exploration and (re)search - online* (4.4.4), as well as the benefits and different stages involved in undertaking the *4P Process* (4.4.5). Upon acquiring this knowledge, I believe practitioners would be less reliant on those traditional forms of training, with potential to be more self-directed and self-sufficient in relation to their own professional development in this area. This idea of enabling teachers to become more autonomous with regards to their own learning is particularly salient given the paucity of workshops, events and training appropriate for their needs in relation to the use of technology in PE according to the teacher's (see 2.4.2).

7.4 Key finding 3 - 'personal and professional motives'

Mindful of Casey's *et al.* (2017a) claim that we are not fully aware of the reasons why PE teachers use technology (see 2.2), the purpose of Chapter 5 was to develop an understanding of why these participants were predisposed towards it, and were

prepared to invest sizable time and effort in those *formal* and *informal* habits and practices associated with its use (see fig. 5). Aware that previous research has focused predominantly on singular, or a limited number of external reasons for why teachers use technology, namely outcomes or consequences relating to the learner (see 2.2), I wanted to find out if there were other reasons why these participants used it. A series of personal and professional motives, not widely reported in the literature, were developed from the participants' accounts, namely *enjoyment and reward* (5.2.1); *duty and responsibility* (5.2.2); *values and beliefs* (5.2.3) and *career advancement* (5.2.4). Those reasons may, in part, explain why these teachers undertook those habits and practices reported (see fig 5), as well as help understand why their *weighted investment* in technology had been long-term and was seemingly ongoing. However, I contend the highly personal and emotive nature of those motives obscured the teachers' ability to recognise arrangements within their schools that prompted them to devote time and effort towards technology, and undertake the practices they did. In the section that follows I will present recommendations for practice focused on those motives reported. Later, I will revisit my last point about those motives obscuring the participants' awareness and appreciation of wider matters impacting on their habits and practices with technology (see 7.5).

Recommendation(s) 3

Until now technology use in schools has largely been promoted based on benefits associated with the learner (see 2.2). However, various personal and professional motives reported by these participants could be included as part of a broader rationale for why teachers should consider using technology within their learning and teaching practices. I am not suggesting those personal and professional reasons alone be used

to prompt teachers' use of technology. Concerns with doing so were highlighted in Chapter 5 when discussing *career advancement* as a motive (see 5.2.4). For example, this particular motive is unlikely to sustain a long term use of technology, and could result in it being hurried into teachers' practices and used in a *'tick box'* manner - as described in Chapter 2 (see 2.3).

Further concerns were raised at the end of Chapters 5 (see 5.2.5) and 6 (see 6.2.7) about the emotive nature and potentially negative affect of those reasons on the teachers' abilities to remain impartial on matters concerning technology. Nevertheless, a more compelling argument for why teachers should include technology in their lessons could be put forward if the personal and professional reasons reported in this study were presented alongside those long-established motives described previously (see 2.2 and 2.5).

Various channels exist that could be used to publicize and promote those personal and professional benefits, such as during learning and development events. For example, instead of primarily focussing on showcasing best practices with technology, training and workshops could highlight those reasons (as well as the more commonly reported motives that focus on the learner) through illustrative examples, or case studies of practitioners and how they have benefitted personally and professionally as a result of employing technology in their practice. In addition, explicit mention of those motives in local and national policy guidelines and strategy documents that aim to promote the use of technology in schools, such as the Scottish Government's recent digital learning and teaching strategy for Scotland (Scottish Government, 2016), would also increase

awareness, and enhance the likely implementation of those guidelines and policy into practice.

7.5 Key finding 4 - 'Underlying factors'

In developing a more sophisticated understanding of why these teachers were predisposed towards technology, I presented a series of underlying factors that I believe unknowingly influenced their *weighted investment* (see fig. 6). Furthermore, I argued those factors, namely: *managers' lack of knowledge and expertise with technology* (6.2.1); *lack of strategic overview* for it (6.2.2), as well as an *emphasis on procurement of technology* (6.2.3) prompted these teachers to undertake the various habits and practices encompassed in the framework (see fig. 6), as well as compounding matters in relation to the time and effort they devoted to technology. Those factors are regarded as underlying, as despite being aware of them the participants were oblivious to how they influenced and shaped their *weighted investment* in technology. In explaining how those factors affected their habits and practices with technology, I suggest they gave rise to many of the barriers to technology use reported in the literature, in particular those relating to: lack of time to learn how to use technology, as well as time to implement it (see 2.4.1); lack of meaningful professional development opportunities (see 2.4.2); and resourcing - particularly issues concerning the physical and organisational infrastructure in place within schools to support the use of technology (see 2.4.3).

Recommendation(s) 4

It is valuable to provide forums and opportunities for practitioners to communicate and share how they have overcome issues and barriers associated with those underlying factors (see 6.2.1 to 6.2.6), for example, organising 'sharing best practice' workshops

and events. However, I contend greater efforts are needed to ensure teachers become more aware of how those factors influence their *weighted investment* in technology. This would require further reflection on the part of practitioners with an emphasis on more socio-political matters pertaining to technology and schooling (see 6.2.7). Though there was little evidence of these participants reflecting on such issues, encouraging signs emerged in the analysis phase with some of them demonstrating their potential and willingness to do so. Post interview both Brian and Ronnie acknowledged in emails they enjoyed the experience, indicating the discussion allowed them to reflect on aspects of their practice they had not considered before. Furthermore, after the follow up interview with Ronnie I made the following observation about this matter:

> I have been impressed by the manner in which he [Ronnie] has conducted himself and the way in which he has responded to my questions i.e. considered and thoughtful answers. He appeared at times to be reflecting and realising things i.e. things [were] becoming more apparent at times throughout the interviews. During the interview Ronnie talked about how he had thought about a particular matter at length after the first interview
>
> Field Journal 12th May 2016

I will put this idea of the teachers' lack of reflection on higher-order matters to one side for the time being, though I will return to discuss it further in a subsequent section (see 7.6.1). Instead, I will focus on *how* and *why* teachers should address those underlying factors. Although it is important to develop awareness of the impact those factors may have on their habits and practices with technology, I suggest this should be a start point for teachers. Once practitioners become aware of the impact of those issues, if they possess appropriate knowledge and expertise they should use this to

diminish, or even remove those underlying factors - as opposed to finding temporary, arguably less sustainable, and sometimes unauthorised ways to work around them. For example, when Mick described acquiring a device that allowed him to set up an independent wireless network in his practical spaces, something he did of his own accord, and paying for the device himself. This practice, in response to the school's lack of WiFi connectivity and policies on what platforms could be used, such as Twitter or YouTube, went unnoticed by colleagues in his school. Arguably working towards removing those factors, such as the restrictive policies or the poor WiFi signal, would be more challenging, and likely increase, initially at least, teachers' *weighted investment* in technology. However, getting rid of those factors would increase the likelihood of technology use being sustained and might perhaps prompt other teachers to begin using it. Interestingly, several of these participants had acquired formal or informal positions that afforded them the opportunity to challenge and address those underlying factors. Informally, all of the participants had attained a particular status amongst their colleagues and were perceived to be the go-to person for technology related matters (see 4.3.2). Formally, several of them had secured positions of responsibility, such as sitting on or leading their school's working group for technology, which allowed them to influence technology agendas within their school and use their knowledge and expertise to advise on matters pertaining to technology procurement, as well as the development and implementation of overarching strategies for technology use (see 4.3.3).

7.6 Key finding 5 - 'the bigger picture'

When presenting a rationale for my study in Chapter 1 I acknowledged Selwyn's (2017) recommendation for future research to develop greater awareness of the *'bigger*

picture' (p.vi) with regards technology use in schools. My final key finding concerns practitioners and their need to become more aware and responsive to those broader issues Selwyn refers to. Issues that often go unnoticed, yet have considerable impact on teachers' habits and practices with technology.

The notion of participants in this study being unaware of *'bigger picture'* matters in relation to their use of technology was first apparent when they discussed the time and effort they invested in it (see 7.2). These teachers were able to describe in detail those distinct habits and practices within the *weighted investment* framework (see fig. 4), as well as indicating the time they devoted to those practices. Some even quantified their investment, for example when Bill described *'...spending four or five hours at home...'* (26th February 2016) undertaking technical duties on his departmental iPads (see 4.4.1). However, I argued these teachers were so engaged in the minutiae of their practices and involvements with technology they overlooked, or were unable to see the broader picture. None of the participants discussed those practices in the framework, or the time and effort invested in them, in collective terms - suggesting they were not fully aware of the extent and scale of their *weighted investment*, or how these demands on their time might make their approaches inaccessible to other teachers in different circumstances.

The ideas discussed at the end of Chapter 5 reappeared in Chapter 6 when examining the underlying factors that influenced the participants *weighted investment* in technology (see fig. 6). Though aware of the factors, these teachers did not realise the impact they had on their habits and practices with technology (see 6.1). In terms of explaining the participants' lack of awareness and ability to scrutinise wider issues

concerning their use of technology I argued technology companies, politicians and policy makers had been influential in determining these circumstances in order to maintain their positions of authority, as well as their economic and corporate interests (see 6.1). I also highlighted how they were able to achieve this by influencing the nature and direction of key debates concerning technology and schooling, and disseminate those messages through indelicate sales pitches, as well as appeals and policies focused on societal and economic needs. Moreover, I emphasized how these arrangements have resulted in technology becoming a background feature in schools allowing it to avoid any sustained critical analysis, to the benefit of the providers and politicians (Selwyn *et al*. 2018)

Recommendation(s) 5

In the previous section I suggested teachers need to reflect further on *'bigger picture'* matters relating to their technology use, and highlighted being encouraged that these participants' displayed a potential to do so (see 7.5.1). However, I believe practitioners may require prompting and initial support in order to realise and critically reflect on those broader issues affecting their technology use. In Goodyear and Casey's (2015) study focused on pedagogical innovation the lead researcher acted as a *'boundary spanner'* (p.190) for the practitioners, namely they provided them with relevant knowledge about the innovation (co-operative learning), and supported the teachers implementation of the approach. In the follow up interviews in this study I believe I may have inadvertently adopted a somewhat similar role when discussing with each teacher tentative ideas developed from my early analysis and interpretations of the data (see 3.6.7). The ideas presented led to some participants thinking differently about their habits and practices with technology, and what might be affecting them. Thus, I

believe there is an argument for closer collaboration between researchers and practitioners when it comes to technology and schooling in order to encourage and extend teachers awareness of *'bigger picture'* issues and arrangements, as well as their ability to scrutinize and, if needed, critique them.

Elsewhere in this chapter I argue for redesigning professional learning in relation to teachers' use of technology (see 7.3.1). I maintain this argument here, believing the inclusion of content and material on such courses and events that raise awareness of wider, more social, ethical and political issues in relation to technology use and schooling is required. Furthermore, developing teachers' abilities to reflect on those matters should also be incorporated. However, given many technology providers now provide and support professional training programs for teachers, for example, opportunities to become a Microsoft[10] or Google[11] Certified Educator, it is likely those courses will promote their products in order to strengthen their own positions within the market. Also, it is unlikely those courses would encourage the level of reflection being advocated here as this could lead to those undertaking the training becoming more aware of broader matters, such as the value attached to technology (see 2.5.1), the rhetoric that often accompanies it (see 2.5.2), as well as the power and control exerted by the technology corporations and politicians (see 2.5.3). This could result in practitioners beginning to question and challenge the current arrangements determined by those who provide and advocate the use of technology, namely the public-private alliances between technology companies, politicians and policy makers, all of whom use both their authority and jurisdiction to further their own agendas by influencing

[10] https://www.microsoft.com/en-gb/learning/mce-certification.aspx

[11] https://teachercenter.withgoogle.com/certification

the devices and applications employed in schools (See 2.5.3). Given their involvement in *leading professional learning* and training to colleagues (4.3.2), and their *involvement in working groups* for technology within their schools (4.3.3), as well as their status amongst colleagues when it comes to matters concerning technology, participants in this study, and other lead users like them, are arguably in a position to shape the nature and direction of professional development in their schools. Moreover, they are able to determine and communicate key messages to colleagues that would enable them to think more critically when it comes to technology use in schools, and consequently challenge the current arrangements.

7.7 Future directions

This study set out to address a knowledge gap repeatedly recognised by Selwyn (2011, 2014 and 2017), namely a lack of research focused on the *'...'messy' realities of educational technology use* in situ*'* (Selwyn, 2014 p.161). Following his recommendation for researchers in this field to adopt broader investigative stances, I examined teachers' practices with technology on multiple levels in order to develop a greater awareness of the *'bigger picture'* (Selwyn, 2017 p.vi) in relation to technology and schooling. This involved a macro level analysis of the wider socio- political backdrop, as well as a meso and micro level examination of national and local contexts in which these participants practiced, and how they influenced their habits and behaviours with technology. This study, in part, addresses a gap identified by Selwyn and others (see Casey *et al.* 2017a; Gard, 2014, Lupton, 2015 and Tearle and Katene, 2005), though I understand both my focus and approach are frequently overlooked, and as such this remains a fruitful area for further study. Furthermore, I am conscious there are limitations in the scale and a scope of what any study can reasonably be asked

to achieve and consider. In the case of the present investigation I underestimated the extent of the wider socio-economic and political issues that would emerge from these participants' accounts, and consequently the space required to fully analyse those macro level matters and how they impacted on the teachers' practices with technology. In view of this, future studies should consider solely focussing on those wider issues discussed, in part, in Chapter 6.

Another natural progression of this study is to extend, refine and substantiate the *weighted investment* framework. There are likely other *formal* and *informal* habits and practices associated with teachers' use of technology that were not reported (see fig. 4), as well as additional personal and professional motives for why practitioners use it (see fig. 5). In addition, there are likely other underlying factors in schools that influence teachers' practices with technology (see fig. 6). In order to extend and validate the ideas presented in my conceptual framework the study could be repeated involving other teachers. For example, recruiting practitioners from other subject areas in the curriculum, such as Drama, English, Geography, Mathematics or Science, who are also recognised as being highly competent with technology and use it frequently in their learning and teaching. This would enable the development of a more substantive theory, and consequently the ability draw broader inferences from it.

In terms of refining and developing different parts of the *weighted investment* framework, a better understanding of teachers' discrete habits and practices with technology or motives for using it, as well as particular underlying factors affecting its use is required. For example, in Chapter 6 *career advancement* was presented as a credible motive for why teachers might involve technology in their practice (see 5.2.4).

However, it is understood this reason has received little attention to date in the literature. Furthermore, given the increased expectation for teachers to use technology (see 2.2), it arguably warrants further examination. Additionally, in Chapter 2 I highlighted the absence of generic guidelines for using technology, highlighting instead an emphasis on reporting current and best practices with particular technologies, as well as identifying potential learning and teaching benefits to be gained from their use (see 2.3). The longevity of those technologies and practices is questionable given the transitory nature of technology. Thus, discrete habits and practices such as the *4P Process* (4.4.5) that can be universally applied to technologies are perhaps more valuable to practitioners, and possibly more enduring. Given the potential some of those discrete behaviours, such as the *4P Process* (4.4.5) have for guiding teachers' practices with technology they also warrant further attention and study.

Finally, in Chapter 2 I highlighted effective use of technology is not widespread in PE, instead it is limited to *'pockets of excellence'* (Tearle and Katene, 2005 p.14). I also acknowledged the importance of identifying and investigating the habits and practices of teachers operating within those pockets in order to develop a more sophisticated understanding of how the potential of technology might be realized, as well as considering how those findings could be used to inform and guide practice across the sector (Tearle and Golder, 2008). This idea of researchers locating and focussing on pockets of best practice needs to continue. In Chapter 6 I examined a series of underlying factors that influenced these participants' *weighted investment* in technology (see fig. 6). There are likely to be schools that are recognised for having strong leadership in relation to technology use, whose senior managers are

knowledgeable and possess skills and expertise with it; where a long-term plan and overarching strategy for the use of technology has been developed and implemented; and where appropriate infrastructures to support its use are in place - such as adequate WiFi connectivity and the availability of technical support. Examining the behaviours and motivations of teachers' in those schools, with respect to their use of technology, would be an interesting comparison to my study. Moreover, studying how those schools addressed those underlying factors would merit further investigation.

7.8 Contribution to knowledge

The existing literature provides insufficient accounts of teachers' practices with technology. As highlighted in Chapter 1, much research carried out in the last decade has been narrow by design, emphasizing the impact of discrete devices, applications and platforms on a limited range of learning and teaching variables (see 1.4.2). Though useful for establishing best practices with technology, as well as identifying potential benefits, this body of research has not resulted in technology use becoming commonplace in PE. Furthermore, I question whether it has led to technology being employed in more purposeful, sustainable ways within schools. I believe my study provides a fresh perspective on teachers' use of technology, achieved by employing a bottom-up approach involving a broader, more critical stance focused on wider matters associated with technology - as opposed to particular uses of it. Discussing, problematizing and subsequently theorizing such matters - as opposed to demonstrating and proving the value of technology - has enabled the development of a framework that has potential to critically inform and guide teachers practices with technology, leading to a more sustained, purposeful use of it within schools.

References

Afshari, M., Abu Bakar, K., Luan, W., S., Abu Samah, B. & Fooi, F., S. (2009) Technology and school leadership, *Technology, Pedagogy and Education*, 18:2, 235-248.

Apple Inc. (2018) *Apple Education-Ignite the creativity in every student*. Retrieved from https://www.apple.com/uk/education/

Arthur, W.B. (2009) *The nature of technology: What it is and how it evolves*, New York: Free Press.

Barbour, R. (2014) *Introducing qualitative research-a student's guide* (2nd ed.), London: SAGE.

Barret, P. (2014) Using information and communications technology in physical education. In Capel, S. & Breckon, P. (Eds.), *A practical guide to teaching physical education in the secondary school* (2nd ed. pp.83-90), Abingdon, England: Routledge.

BBC News-Education (2002, January 9th) *Classrooms of the future*. Retrieved from http://news.bbc.co.uk/1/hi/education/1749817.stm

Beauchamp, G., Burden, K. & Abbinett , E. (2015) Teachers learning to use the iPad in Scotland and Wales: a new model of professional development*, Journal of Education for Teaching*, 41:2, 161-179.

BECTA (British Educational Communications and Technology Agency) (2005) Body and mind-A report on the use of ICT in physical education (PE), *BECTA ICT Research*. Retrieved from http://39lu337z51l1zjr1i1ntpio4-wpengine.netdna-ssl.com/wp-content/uploads/2016/04/ict_pe.pdf

BECTA (British Educational Communications and Technology Agency) (2006) The Becta Review 2006 Evidence on the progress of ICT in education, *BECTA ICT Research*. Retrieved from https://dera.ioe.ac.uk/1427/1/becta_2006_bectareview_report.pdf

Bernard, H. R. (2013) *Social research methods-qualitative and quantitative approaches,* California: SAGE.

BESA (British Educational Suppliers Association) (2018) Schools plan to increase their ICT spending for the first time in three years Accessed on 12th August 2018 https://www.besa.org.uk/news/press-release-schools-plan-increase-ict-spending-first-time-three-years/

Bisgin, H. (2014) Analyzing the attitudes of physical education and sport teachers towards technology, *The Anthropologist*, 18:3, 761-764.

Blair, R. (2006) Planning for pupils' learning in broader dimensions of the curriculum 2: key skills and the use of information and communications technology. In Capel, S., Breckon, P. & O'Neill, J. (Eds.) *A practical guide to teaching physical education in the secondary school* (pp. 80-88), Abingdon, England: Routledge.

Bringer, J.D., Johnston, L.H. & Brackenridge, C.H. (2006) Using computer-assisted qualitative data analysis software to develop a Grounded Theory project, *Field Methods* 18:3, 245-266.

Bromley, H. (1998) Introduction: Data-Driven Democracy? Social Assessment of Educational Computing. In Apple, M.W & Bromley, H. *Education/Technology/Power-Educational Computing as a Social Practice* (Eds. pp.1-25), New York: State University of New York Press.

Brooker, S. & Daley-James, D. (2013) Using ICT to improve children's planning, performing and evaluating skills in gymnastics, in a year 2 class, to enhance their technique, *Education 3-13*, 41:1, 32-38.

Brookfield, S. D. (2005) *The Power of Critical Theory for Adult Learning and Teaching,* Maidenhead, England: Open University Press.

Bryman, A. (2008) *Social research methods* (3rd ed.), Oxford, England: Oxford University Press.

Brynjolfsson, E. & Hitt, L.M. (2000) Beyond computation: Information technology, organizational transformation & business performance, *Journal of Economic Perspectives*, 14:4, 23-48.

Buckingham, D., Scanlon, M. & Sefton-Green. J (2001) Selling the digital dream: marketing educational technology to teachers and parents (pgs. 20-40). In Loveless, A. & Ellis, V. (Eds.) *ICT, pedagogy & the curriculum* (pp. 20-40), London: Routledge Falmer.

Buckingham, D. (2007) *Beyond Technology-children's learning in the age of digital culture,* Cambridge, England, Polity Press.

Calderon, A., Lopez-Chicheri, I., Fernandez-Rio, J. & Sinelnikov, O.A. (2016) Antonio: "I really want them to be engaged and learn" The use of social media in higher education. In Casey, A., Goodyear, V.A. & Armour, M.K. *Digital technologies and learning in physical education-pedagogical cases* (Eds. pp. 86-103), Abingdon, England: Routledge.

Casey, D. & Dyson, B. (2009) The implementation of models-based practice in physical education through action research, *European Physical Education Review*, 15:2, 175–199.

Casey, A., Goodyear, V.A., & Armour, K.M. (2017a) Articulating "pedagogies of technology" through thirteen "pedagogical cases". In Casey, A., Goodyear,

V.A., & Armour, K.M. *Digital technologies and learning in physical education-pedagogical cases* (Eds. pp.247-257), Abingdon, England: Routledge.

Casey, A., Goodyear, V.A. & Armour, K.M. (2017b) Rethinking the relationship between pedagogy, technology and learning in health and physical education, *Sport, Education and Society*, 22:2, 288-304.

Casey, A & Jones, B. (2011) Using digital technology to enhance student engagement in physical education, *Asia-Pacific Journal of Health, Sport and Physical Education*, 2:2, 51-66.

Casey, A. & MacPhail, A. (2018) Adopting a models-based approach to teaching physical education, *Physical Education and Sport Pedagogy*, 23:3, 294-310.

Cengiz, C. (2015) The development of TPACK, technology integrated self-efficacy and instructional technology outcome expectations of pre-service physical education teachers, *Asia-Pacific Journal of Teacher* Education, 43:5, 411-422.

Centeio, E.E. (2017) The have and have nots: An ever-present digital divide, *Journal of Physical Education, Recreation & Dance*, 88:6, 11-12.

Chambers, F.C., Sherry, J., Murphy, O., O'Brien, W. & Breslin, G. (2017) James: physical education teacher. In Casey, A., Goodyear, V.A. & Armour, M.K. *Digital technologies and learning in physical education-pedagogical cases* (Eds. pp. 49-68), Abingdon, England: Routledge.

Charmaz, K. (2001) Qualitative interviewing and grounded theory analysis. In Gubrium, J.F. & Holsteing, J.A. *Handbook of interview research-context & method* (Eds. pp. 675-694), California: SAGE.

Charmaz, K. (2006) *Constructing grounded theory: A practical guide through qualitative analysis,* London: SAGE.

Charmaz, K. (2012) The power and potential of grounded theory, *Medical Sociology Online,* 6: 23, 2-15.

Charmaz, K. (2014) *Constructing Grounded Theory* (2nd ed.), London: SAGE.

Chen, C.H. (2008) Why do teachers not practice what they believe regarding technology integration? *Journal of Educational Research*, 102:1, 65–75.

Cheng, M.M.H. & So, W.W.M. (2012) Analysing teacher professional development through professional dialogue: an investigation into a university-school partnership project on enquiry learning, *Journal of Education for Teaching - International research and pedagogy*, 38:3, 323-341.

Clapham, E.D., Sullivan, E.C. & Ciccomascolo, L.E. (2015) Effects of a physical education supportive curriculum and technological devices on physical activity, *The Physical Educator,* 72, 102-116.

Clarke, A. E. (2005) *Situational analysis: Grounded theory after the postmodern turn,* Thousand Oaks, California: SAGE.

Clarke, A.E. & Friese, C. (2007) Grounded Theorizing Using Situational Analysis

Clarke, N. (2008) Information and communications technology in physical education: an innovative teaching and learning approach. In Lavin, J. (ed.) *Creative approaches to physical education: Helping children to achieve their true potential,* (pp. 92-107), Abingdon, England: Routledge.

Cohen, L., Manion, L. & Morrison, K. (2011) *Research Methods in Education* (7th ed.) Abingdon, England: Routledge.

Collins, K. & Higgins, S. (2013, November 15th) If tech is the answer, what's the question? *Times Educational Supplement (Scotland)* p.20-21.

Condie, R., Munro, B., Muir, D. & Collins, R. (2005) The Impact of ICT initiatives in Scottish schools: Phase 3, *Scottish Government*. Retrieved from https://www2.gov.scot/Publications/2005/09/14111116/11424

Condie, R. & Livingston, K. (2007) Blending online learning with traditional approaches: changing practices*, British Journal of Educational Technology*, 38:2, 337-348.

Condie, R. & Munro, B. (2007) The impact of ICT in schools-a landscape review, *BECTA Research.* Retrieved from http://oei.org.ar/ibertic/evaluacion/sites/default/files/biblioteca/33_impact_ict_in_schools.pdf

Conlon, T. (2008) The dark side of GLOW: Balancing the discourse, *Scottish Educational Review*, 40:2, 64-75.

Conlon, T. & Simpson, M. (2003) Silicon valley versus silicon glen: the impact of computers upon teaching and learning: a comparative study, *British Journal of Educational Technology*, 34:2, 137-150.

Cook, D.A., Levinson, A.J. & Garside, S. (2012) Time and Learning Efficiency in Internet-Based Learning: A Systematic Review and Meta-Analysis, *Advances in Health Sciences Education*, 15:5, 755-770.

Costa, C., Hammond, M. & Younie, S. (2017) Call for Papers for Special Issue: Theorising the educational use of technology. *Technology, Pedagogy and Education*. Retrieved from http://explore.tandfonline.com/cfp/ed/rtpe-educational-use-of-technology

Cresswell, J. W. (2009) *Research design: Qualitative, quantitative & mixed methods approaches* (3rd ed.), Thousand Oaks, California: SAGE.

Cresswell, J. W. (2013) *Qualitative inquiry & research design: Choosing among five approaches* (3rd ed.), Thousand Oaks, California: SAGE.

Crotty, M. (1998) *The foundations of social research: Meaning & perspective in the research process,* London: SAGE.

Cuban, L. (2001) *Oversold and underused: computers in the classroom*, USA: Harvard University Press.

Culp, K.M., Honey, M. & Mandinach, E. (2005) A retrospective on twenty years of educational technology policy, *Journal of Educational Computing Research,* 32, 279-307.

David, M. & Sutton, C.D. (2011) *Social research-an introduction* (2nd ed.), London: SAGE.

Davidson, J.K. & McQueen, I. (2006) Perspectives on digital technology in a remote rural school: a qualitative study. *Paper presented at the European Conference on Educational Research, University of Geneva*, 13-15 September 2006.

DfE (Department for Education and Employment) (1997) Connecting the learning society. London: *HMSO* (pp. 1-32).

DfE (Department for Education and Employment) (2017) Teacher Workload Survey 2016 Research brief February 2017. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/594696/TWS-2016_FINAL_Research_brief_Feb_2017.pdf

Dey, I. (2007) Grounding Categories. In Bryant, A. & Charmaz, K. The *SAGE Handbook of Grounded Theory* (Eds. pp. 167-190), London, SAGE.

Dollman, J., Boshoff, K. & Dodd, G. (2006) The relationship between curriculum time for physical education and literacy & numeracy standards in South Australian primary schools, *European Physical Education Review*, 12:2, 151-163.

Donaldson, G. (2010) Teaching Scotland's future - Report of a review of teacher education in Scotland*, Scottish Government*. Retrieved from https://www2.gov.scot/resource/doc/337626/0110852.pdf

Eagleton, T. (1991) *Ideology: An introduction,* London: Verso.

Eberline, A.D. & Richards, K.A.R. (2013) Teaching with technology in physical education, *Strategies-A Journal for Physical and Sport Educators*, 26:6, 38-39.

Education Scotland (2014) Building society young people's experiences and outcomes in the technologies. Retrieved from https://education.gov.scot/improvement/documents/tec8-impactreport.pdf

Elliot, D., Wilson, D. & Boyle, S. (2014) Science learning via multimedia portal resources: The Scottish case, *British Journal of Educational Technology,* 45:4, 571–580.

Enright, E., Robinson, J., Hogan, A., Stylianou, M., Hay, J., Smith, F. & Ball, A. (2017) Jarrod: the promise and messy realities of digital technology in physical education. In Casey, A., Goodyear, V.A. & Armour, M.K. (Eds.) *Digital technologies and learning in physical education-pedagogical cases* (pp. 173-191). Abingdon, England: Routledge.

Esterberg, K.G. (2002) *Qualitative methods in social research,* USA: McGraw-Hill.

Education Scotland (2015) Consultation on the development of a digital learning & teaching strategy for Scotland supporting school years education. Retrieved from https://consult.gov.scot/learning-directorate/digital learning/supporting_documents/Consultation%20on%20digital%20learning%20and%20teaching%20strategy%20%20consultation%20document.pdf

Education Scotland (2016) Review of local authorities' actions to tackle unnecessary bureaucracy and undue workload in schools September 2016. Retrieved from https://education.gov.scot/improvement/Documents/Review-of-Local-Authorities.pdf

Education Scotland (2017) About developing the education profession. Retrieved from https://education.gov.scot/scottish-education-system/policy-for-scottisheducation/developing-the-education-profession/About%20developing%20the%20education%20profession

Education Scotland (2018) Education Scotland launches new national model of professional learning. Retrieved from https://www.scelscotland.org.uk/whats-happening/news/education-scotland-launches-new-national-model-of-professional-learning/

Ertmer, P.A. (1999) Addressing first- and second-order barriers to change: strategies for technology integration, *Educational Technology Research and Development*, 47, 47–61.

Ertmer, P.A., Ottenbreit-Leftwich, A.T., Sadik, O., Sendurur, E. & Sendurur, P. (2012) Teacher beliefs and technology integration practices: A critical relationship, *Computers & Education*, 59, 423–435.

European Commission (2015) Shaping career-long perspectives on teaching, *Brussels: European Commission*. Retrieved from http://ec.europa.eu/education/library/reports/initial-teachereducation_en.pdf

Fletcher, T., Vasily, A., Bullock, S.M., Kosnik, C., & Ní Chróinín, D. (2016) Andy: Blogging with students-Educational visions and digital realities. In A. Casey, V.A. Goodyear, & K.M. Armour *Digital technologies and learning in physical education: Pedagogical cases* (Eds. pp. 104–120), Abingdon, England: Routledge.

Franklin & Sessoms (2005) A situative perspective on a collaboratibe model for integrating technology into teaching, *Journal of Educational Computing Research*, 32:4 315-328.

Fullan, M. (1999) *Change forces: The sequel*, London: Falmer Press.

Gard, M., Hickey-Moodey, A. & Enright, E. (2013) Youth culture, physical education and the question of relevance: after 20 years, a reply to Tinning & Fitzclarence, *Sport, Education and Society*, 18:1, 97-114.

Gard, M. (2014) eHPE: a history of the future, *Sport, Education and Society*, 19:6, 827-845.

Ghosal, V. & Nair-Reichert, U. (2009) Investments in modernization, innovation and gains in productivity: evidence from firms in the global paper industry, *Research Policy*, 38:3, 536-47.

Glaser, B.G. & Strauss, A.L. (1967) *The discovery of grounded theory: Strategies for qualitative research*, Oxon, England: Routledge.

Glaser, B.G. (2001) *The grounded theory perspective: Conceptualization contrasted with description*, Mill Valley, CA: The Sociology Press.

Gleddie, D., Feith, J., Howe, D., Larsson, H., Cale, L. & Casey, A. (2017). Joey: Social media as a tool for professional development. In A. Casey, V.A. Goodyear, & K.M. Armour *Digital Technologies and Learning in Physical Education: Pedagogical cases.* (Eds. pp.121-137), Abingdon, England: Routledge.

GLOW Digital Learning for Scotland (online) GLOW for educators. Retrieved from https://glowconnect.org.uk/about-glow/glow-for-educators/

Goepel, J. (2012) Upholding public trust: an examination of teacher professionalism and the use of teachers' standards in England, *Teacher Development: An international journal of teachers' professional development*, 16:4, 489-505.

Goodwyn, A. (2009) English teachers in the digital age: a case study of policy and expert practice from England, *English in Aotearoa*, 69, 36-44.

Goodyear, V.A. & Casey, A. (2015) Innovation with change: developing a community of practice to help teachers move beyond the 'honeymoon' of pedagogical renovation, *Physical Education and Sport Pedagogy*, 20:2, 186-203.

Gotkas, Z (2012) The attitudes of physical education & sport students towards information & communication technologies, *TechTrends*, 56:2, 22-30.

Gov.UK (2014, February 4th) Year of Code and £500,000 fund to inspire future tech experts launched, *Gov.UK*. Retrieved from https://www.gov.uk/government/news/year-of-code-and-500000-fund-to-inspire-future-tech-experts-launched

Gray, D.E. (2013) *Doing research in the real world* (3rd ed.), London: SAGE.

Gratton, C. & Jones, I. (2010) *Research methods for sports studies* (2nd ed.), London: Routledge.

Greener, I. (2011) *Designing social research,* London: SAGE.

GTCS (General Teaching Council for Scotland) (2012a) The Standards for Registration: mandatory requirements for Registration with the General Teaching Council for Scotland. Retrieved from http://www.gtcs.org.uk/web/FILES/the-standards/standards-for-registration-1212.pdf

GTCS (2012b) (General Teaching Council for Scotland) The Standard for Career-Long Professional Learning: supporting the development of teacher professional learning. Retrieved from http://www.gtcs.org.uk/web/FILES/the-standards/standard-for-career-long-professional-learning-1212.pdf

Guba, E.G., & Lincoln, Y.S. (1989). *Fourth generation evaluation*, Newbury Park, CA: SAGE.

Gray, S., Maclean, J. & Mulholland, R. (2012) Physical education within the Scottish context. A matter of policy, *European Physical Education Review*, 18:2, 258-272.

Gray, S., Mulholland, R. & Maclean, J. 2012, The ebb and flow of curriculum construction in physical education: a Scottish narrative, *Curriculum Journal*, 23:1, 59-78.

Gubacs-Collins, K. & Juniu, S. (2009) The mobile gymnasium: Using tablet PCs in physical education, *Journal of Physical Education, Recreation & Dance*, 80:2, 24-31.

Hall, A. & Leigh, J. (2001) *ICT in Physical Education*, Cambridge, England: Pearson Publishing.

Hardman, K. & Marshall, J. (2000) The state of physical education in schools in international context, *European Physical Education Review,* 6:3, 203-229.

Harris, C. J. (2006, April). Managing inquiry-based science learning environments: Challenges in enacting reform curricula. Paper presented at an invited session

of the annual meeting of the American Educational Research Association, San Francisco, CA.

Hauge, E.T. & Norenes, S.O. (2015) Collaborative leadership development with ICT: experiences from three exemplary schools, *International Journal of Leadership in Education*, *18*:3, 340-364.

Halpin, D., Power, S. & Fitz, J. (1997) In the grip of the past? Tradition, traditionalism and contemporary schooling, *International Studies in Sociology of Education*, 7:1, 3-20.

Herrington, J., Herrington, A. Mantei, J., Olney, I. & Ferry, B. (2009) Introduction: Using mobile technologies to develop new ways of teaching and learning, Jan Herrington, Anthony Herrington, Jessica Mantei, Ian Olney and Brian Ferry. In Herrington, J., Herrington, A. Mantei, J., Olney, I. & Ferry, B. *New technologies, new pedagogies: Mobile learning in higher education*, (Eds. Pp. 1-14), Wollongong: University of Wollongong. Retrieved from http://ro.uow.edu.au/

Hastie, P.A. Ashley Casey & Anne-Marie Tarter (2010): A case study of wikis and student-designed games in physical education, *Technology, Pedagogy and Education*, 19:1, 79-91.

HMIE (Her Majesty's Inspectorate of Education) (2004) How good is our school? Self-Evaluation Series:Using ICT in Learning and Teaching. Retrieved from http://www.hmie.gov.uk/documents/publication/hgiosict.pdf

HMIE (Her Majesty's Inspectorate of Education) (2005) The integration of information and communications technology in Scottish schools - An interim report by HM Inspectors of Education October 2005.

HMIE (Her Majesty's Inspectorate of Education) (2007) Improving Scottish education ICT in learning and teaching. Retrieved from https://dera.ioe.ac.uk/6488/7/iseictilat_Redacted.pdf

Herold, F. (2011) Becoming an effective secondary school physical education teacher. In Armour, K.M. (2011) *Sport Pedagogy: An Introduction for Teaching and Coaching* (ed. pp. 258-270), London: Routledge.

Hesse-Biber, S.N. (2007) Teaching grounded theory. In Bryant, A. & Charmaz, K. *The SAGE handbook of grounded theory*, (Eds. pp. 311-338), London: SAGE.

Hew, K.F. & Brush, T. (2007) Integrating technology into K-12 teaching and learning: current knowledge gaps and recommendations for future research, *Education Technology Research and Development,* 55:3, 223-252.

Hildenbrand, B. (2007) Mediating structure & interaction in grounded theory. In Bryant, A. & Charmaz, K. *The SAGE handbook of grounded theory*, (Eds. pp. 539-564), London: SAGE.

Hillis, P. & Munro, B. (2005) ICT in history education-Scotland and Europe, *Social Science Computer Review*, 23:2, 190-205.

Hilvoorde, I.V. & Koekoek, J. (2017) Worldwide developments of digital technology in physical education. In Bund, A., Scheuer, C. & Holzweg, M. *Changes in Childhood and Adolescence: Current Challenges for Physical Education.* (Eds. pp. 17-19), Berlin: Logos Verlag.

Hilvoorde, I.V. & Koekoek, J. (2018) Next generation PE: thoughtful integration of digital technologies. In Koekoek, J. & Hilvoorde, I.V. *Digital technology in physical education global perspectives* (Eds. pp.1-16), Abingdon, England: Routledge.

Hobbs, R. & Tuzel, S. (2017) Teacher motivations for digital and media literacy: An examination of Turkish educators, *British Journal of Educational Technology*, 48:1, 7-22.

Holton, J.A. (2007) The coding process & its challenges. In Bryant, A. & Charmaz, K. *The SAGE handbook of grounded theory*, (Eds. pp. 265-290), London: SAGE.

Holstein, J. & Gubrium, J. (2004) The active interview. In Silverman, D. *Qualitative research: theory, method and practice* (ed. pp. 140-161), London: SAGE.

Hood, J. (2007) Orthodoxy versus power: The defining traits of grounded theory. In Bryant, A. & Charmaz, K. *The SAGE handbook of grounded theory*, (Eds. pp. 151-164), London: SAGE.

Horrell, A, Sproule, J & Gray, S. (2012) Health and wellbeing: a policy context for physical education in Scotland, *Sport, Education and Society*, 17:2,163-180.

Iphofen, R. (2009) *Ethical decision making in social research - A practical guide* Palgrave Macmillan.

Issa, T., Isaías, P. & Kommers P. (2016) Editorial, *Journal of Information, Communication & Ethics in Society*, 14:4, 310-312.

Johnson, J.M. (2001) In-depth interviewing Johnson. In Gubrium, J.F. & Holsteing, J.A. *Handbook of interview research-context & method* (Eds. pp. 103-121), California: SAGE.

Johnson, J.C. & Weller, S.C. (2001) Elicitation techniques for interviewing. In Gubrium, J.F. & Holsteing, J.A. *Handbook of interview research-context & method* (Eds. pp. 491-515), California: SAGE.

Jones, E., Schupbach, R., Harvey, S. Bulger, S., & Voelker, D. (2016) Rick: 'Energize and educate at every age'-Technology integration over a teaching career. In Casey, A., Goodyear, V.A. & Armour, K.M. *Digital Technologies and Learning in Physical Education: Pedagogical cases.* (Eds. pp.154-172), Abingdon, England: Routledge.

Judge, S & O'Bannon, B (2007) Integrating technology into field-based experiences: a model that fosters change, *Computers in Human Behavior* 23, 286–302.

Karaseva, A., Pruulmann-Vengerfeldt, P. & Siibak, A. (2017): Relationships between in-service teacher achievement motivation and use of educational technology: case study with Latvian and Estonian teachers, *Technology, Pedagogy and Education*, 27:1, 33-47.

Kelle, U. (2007) The development of categories: Different approaches in grounded theory. In Bryant, A. & Charmaz, K. *The SAGE handbook of grounded theory*, (Eds. pp. 191-213), London: SAGE.

Koehler, M. J. & Mishra, P. (2009). What is technological pedagogical content knowledge?, *Contemporary Issues in Technology and Teacher Education*, 9:1, 60-70.

Kopcha, T.J. (2012) Teachers' perceptions of the barriers to technology integration and practices with technology under situated professional development, *Computers & Education*, 59, 1109–1121.

Kraut, R., Brynin, M. & Kiesler, S. (2006) *Computers, phones, & the internet: Domesticating information technology,* New York: Oxford University Press.

Krefting, L. (1991) Rigor in qualitative research: The assessment of trustworthiness, *The American Journal of Occupational Therapy*, 45, 3.

Koehler, M.J., & Mishra, P. (2009). What is technological pedagogical content knowledge?, *Contemporary Issues in Technology and Teacher Education*, 9:1*, 60-70.*

Koekoek, J., van der Mars, H., van der Kamp, J., Walinga, W. & Hilvoorde, I.V. (2018). Aligning Digital Video Technology with Game Pedagogy in Physical Education, *Journal of Physical Education, Recreation and Dance*, 89:1*,* 12-22.

Kopcha, T.J. (2012) Teachers' perceptions of the barriers to technology integration and practices with technology under situated professional development, *Computers & Education* 59, 1109–1121.

Kretschmann, R. (2012) What do physical education teachers think about integrating technology in physical education?, *European Journal of Social Sciences,* 27:3, 444-448.

Kretschmann, R. (2015a) Physical education teachers' subjective theories about integrating information communications technology (IT) into physical education, *The Turkish Online Journal of Educational Technology*, 14, 168-96.

Kretschmann, R. (2015b) Effect of physical education teachers' computer literacy on technology use in physical education, *The Physical Educator*, 72, 261-277.

Kvale, S. (2007) *Doing interviews,* London: SAGE.

Larrivee, B. (2008) Development of a tool to assess teachers' level of reflective practice, *Reflective Practice*, 9:3, 341-360.

Langdridge, D. (2007). *Phenomenological psychology: Theory, research & method.* Harlow, England: Pearson Education.

Lavay, B., Sakai, J., Ortiz, C. & Roth, K. (2015) Tablet technology to monitor physical education IEP goals and benchmarks, *Journal of Physical Education, Recreation & Dance*, 86:6, 16-23.

Legrain, P., Gillet, N., Gernigon, C. & Lafreniere, M-A. (2015) Integration of information and communication technology and pupils' motivation in a physical education setting, *Journal of Teaching in Physical Education,* 34, 384-401.

Leigh-Star, S. (2007) Living grounded theory: Cognitive and emotional forms of pragmatism. In Bryant, A. & Charmaz, K. *The SAGE handbook of grounded theory*, (Eds. pp. 75-94), London: SAGE.

Lempert, L.B. (2007) Asking Questions of the Data: Memo Writing in the Grounded Theory Tradition. In Bryant, A. & Charmaz, K. *The SAGE handbook of grounded theory*, (Eds. pp. 245-264), London: SAGE.

Levent-Ince, M., Goodway, J.D., Ward, P. & Lee, M-A. (2006) The effects of professional development on technological competency and the attitudes urban physical education teachers have toward using technology, *Journal of Teaching in Physical Education*, 25:4, 428-440.

Lievrouw, L.A. & Livingstone, S. (2006) Introduction to the first edition (2002) Social Shaping and Consequences of ICTs. In Lievrouw, L.A. & Livingstone, S *The handbook of new media - Social Shaping and Social Consequences of ICTs: Updated Student Edition* (2nd ed.) (Eds. pp.15-32) London: SAGE.

Lincoln, YS. & Guba, EG. (1985) *Naturalistic Inquiry,* Newbury Park, CA: SAGE.

Livingston, K. & Condie, R. (2006) The impact of an online learning program on teaching and learning strategies, *Theory Into Practice,* 45:2, 150-158.

Locke, K. (2007) Rational control and irrational freeplay: Dual-thinking modes as necessary tension in grounded theorizing. In Bryant, A. & Charmaz, K. *The SAGE handbook of grounded theory*, (Eds. pp. 565-579), London: SAGE.

Lockyer, L. and Patterson, J. (2007*)* Technology use, technology views: anticipating ICT use for beginning physical and health education teachers, *Issues in Informing Science and Information Technology,* 4, 261-267.

Lund, J. & Tannehill, D. (2014) *Standards-based physical education curriculum development* (3rd ed.) Burlington, MA: Jones & Bartlett Learning.

Lupton, D. (2015) Data assemblages, sentient schools and digitised health and physical education (response to Gard), *Sport, Education and Society*, 20:1, 122-132.

Legard, R., Keegan, J. & Ward, K. (2003) In-depth interviews. In Ritchie, J. & Lewis, J. (2003) Qualitative research practice-A guide for social science students and researchers, (Eds. pp. 138-169), London: SAGE.

Issroff, K. & Scanlon, E. (2002) Educational technology: the influence of theory, *Journal of Interactive Media in Education*, 6, 1-12.

Hilvoorde, I. and Koekoek, J. (2018) Next generation PE: thoughtful integration of digital technologies. In Koekoek, J. & Hilvoorde, I. *Digital technology in PE-global perspectives* Eds. pp. 1-16) Abingdon, England: Routledge.

Mackenzie, D. & Wajcman, J. (1985) *The social shaping of technology,* Milton Keynes, England: Open University Press.

Maxwell, J. A. (2012) *A realist approach for qualitative research,* Thousand Oaks, California: SAGE.

Maxwell, J. A. (2013) *Qualitative research design-an interactive approach,* (3rd ed.) Thousand Oaks, California: SAGE.

May, T. (2001) *Social Research: Issues, methods and process* (3rd ed.), Maidenhead, England: Open University Press.

McCaughtry, N. & Dillon, S.R. (2008) Learning to use PDAs to enhance teaching: The perspectives of preservice physical educators, *Journal of Technology and Teacher Education* 16:4, 483-508.

McNeill, M., Mukherjee, S. & Singh, G. (2010) Podcasting in physical education teacher education, *Journal of Research in Health, Physical Education, Recreation, Sport & Dance*, 5:1, 16-19.

Menter, I., Elliot, D. , Hulme, M., Lewin, J. & Lowden, K. (2011) *A guide to practitioner research in education,* London: SAGE.

Miles, M.B. & Huberman, A.M. (1994) *An expanded sourcebook qualitative data analysis* (2nd ed.) Thousand Oaks, California: SAGE.

Miles, M., Huberman, A. & Saldaña, J. (2014). *Qualitative data analysis: A methods sourcebook* (3rd ed.), Thousand Oaks, California: SAGE.

Miller, J. (2015) ICT & general capabilities in the Australian curriculum. In Calcott, D., Miller, J. & Wilson-Gahan, S. *Health and physical education: Preparing educators for the future* (2nd ed.) (Eds. pp.127-142), Victoria: Cambridge University Press

Miller, D.J. & Robertson, D.P. (2011) Educational benefits of using game consoles in a primary classroom: A randomised controlled trial, *British Journal of Educational Technology,* 42:5, 850–864.

Mishra, P. & Koehler, M. J. (2006) Technological pedagogical content knowledge: A framework for teacher knowledge, *Teachers College Record,* 108:6, 1017–1054.

Mruck, K. & Mey, G. (2007) Grounded theory & reflexivity. In Bryant, A. & Charmaz, K. *The SAGE handbook of grounded theory* (Eds. pp. 515-538), London: SAGE.

Morse, J.M. (2007) Sampling in grounded theory. In Bryant, A. & Charmaz, K. *The SAGE handbook of grounded theory* (Eds. pp. 229-244), London: SAGE.

Morton, K. (2017) The use of new and emerging digital technologies in physical education. In Stidder, G. & Hayes, S. *The really useful physical education book: Learning & teaching across the 11-16 age range* (2nd ed.) (Eds. pp. 246-259), London: Routledge.

Mumtaz, S. (2000) Factors affecting teachers' use of information and communications technology: a review of the literature, *Journal of Information Technology for Teacher Education*, 9:3, 319-342.

NOF (New Opportunities Fund) (2000) ICT Training for Teachers and School Librarians: Information for Schools. Retrieved from www.nof.org.uk (now Big Lottery Fund)

OECD (Organisation for Economic Co-operation and Development) (2015a), *Students, Computers and Learning: Making the Connection,* PISA, OECD Publishing. *http://dx.doi.org/10.1787/9789264239555-en*

OECD (Organisation for Economic Co-operation and Development) (2015b) Teaching in Focus - 12 (July).

OECD (Organisation for Economic Co-operation and Development) (2016) Innovating education and educating for innovation: the power of digital

technologies and skills, *OECD Publishing: Paris.* Retrieved from http://www.oecd.org/fr/innovation/innovating-education-and-educating-for-innovation-9789264265097-en.htm

OFSTED (Office for Standards in Education) (2002) ICT in Schools: Effect of government initiatives Secondary Physical Education June 2002

OFSTED (Office for Standards in Education) (2004) 2004 Report: ICT in schools-The impact of government initiatives Secondary physical education. Retrieved from https://dera.ioe.ac.uk/4843/

OFSTED (Office for Standards in Education) (2011) ICT in schools 2008–11 An evaluation of information and communication technology education in schools in England 2008–11. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/181223/110134.pdf

OFSTED (Office for Standards in Education) (2012) Beyond 2012 –outstanding physical education for all Physical education in schools 2008–12. Retrieved from www.ofsted.gov.uk/resources/120367

Oliver, M. (2013) Learning technology: Theorizing the tools we study, *British Journal of Educational Technology*, 44:1, 31-43.

O'Loughlin, J., Nı´ Chroinin, D. & O'Grady, D. (2013) Digital video: The impact on children's learning experiences in primary physical education, *European Physical Education Review,* 19:2, 165-182.

O'Neill-Green, D., Cresswell, J.W., Shope, R.J. & Plano-Clark, V.L. (2007) Grounded theory & racial/ethnic diversity. In Bryant, A. & Charmaz, K. *The SAGE handbook of grounded theory* (Eds. pp. 472-492), London: SAGE.

Orlando, J. (2014). Veteran teachers and technology: Change fatigue and knowledge insecurity influence practice. *Teachers and Teaching: Theory and Practice*, 20:4, 427-439.

Ottenbreit-Leftwich, A.T., Glazewski, K.D., Newby, T.J. & Ertmer, P.A. (2010) Teacher value beliefs associated with using technology: Addressing professional and student needs *Computers & Education*, 55, 1321–1335.

Ottestad, G. (2013) School leadership for ICT and teachers' use of digital tools, *Nordic Journal of Digital Literacy,* 2, 107-125.

Palao, J.M., Hastie, P.A. Cruz, P.G. & Ortega, E. (2015) The impact of video technology on student performance in physical education, *Technology, Pedagogy and Education*, 24:1, 51-63.

Parker, M., Morrison, J., Patton, K., Babkes Stellino, M., Hinchion, C. & Hall, K., (2017). Jamie: 'I couldn't teach without technology' A teacher and student learning journey. In Casey, A., Goodyear, V.A. & Armour. K.M. *Digital technologies & learning in physical education: Pedagogical cases* (Eds. pp.31-49), Abingdon, England: Routledge.

Parton, G. & Light, M. (2010) Using ICT to enhance learning in physical education. In Bailey, R. *Physical education for learning: A guide for secondary schools* (Ed. pp. 129-144), London: Continuum.

Papastergiou, M. (2011) Physical Education and Sport Science Undergraduate Students as Multimedia and Web Developers: moving from the user's to the creator's perspective, *Education and Information Technologies,* 16, 281-299.

Papastergiou, M., Gerodimos, V. & Antoniou, P. (2011). Multimedia blogging in physical education: Effects on student knowledge and ICT self-efficacy, *Computers and Education*, 57, 1998-2010.

Patton, M.Q. (1990) *Qualitative evaluation and research methods*, Thousand Oaks, California: SAGE.Prestridge, S. (2012) The beliefs behind the teacher that influences their ICT practices, *Computers & Education,* 58:1, 449-458.

Pritchett, C.C., Wohleb, E.C. & Pritchett, C.G. (2103) Educators' perceived importance of web 2.0 technology applications, *TechTrends* 57, 2, 33-38.

Punch, K.F. (2014) *Introduction to social research quantitative and qualitative approaches,* (3rd ed.) London: SAGE.

Pyle, B. & Esslinger, K (2014) Utilizing Technology in physical education: Addressing the obstacles of integration, *Educational Technology*, 80:2, 35-39.

Riessman, C.K. (2008) *Narrative methods for the human sciences*, Thousand Oaks, California: SAGE.

Robson, C. (2011) *Real World Research* (3rd ed.), Chichester, England: Wiley & Sons

Roth, K. (2014) Technology for tomorrow's teachers, *The Journal of Physical Education Recreation & Dance*, 85:4, 3-5.

Sandelowski, M. (1993), Rigor or rigor mortis: the problem of rigor in qualitative research revisited, *Advances in nursing science*, 16:2*, 1*-8.

Savin-Baden, M. & Major, C. H. (2013) *Qualitative research-The essential guide to theory and practice*, Oxon, England: Routledge.

Schwandt, T.A. (1994) Constructivist, Interpretivist Approaches to Human Inquiry. In Denzin, N. K & Lincoln, Y. S. *Handbook of Qualitative Research* (Eds. pp. 118-137), Thousand Oaks, California: SAGE.

Schwandt, T.A. (1998) Constructivist, interpretivist approaches to human inquiry In. Denzin, N. K. & Lincoln, Y. S. *The landscape of qualitative research-theories and issues* (Eds. pp.221-259), Thousand Oaks, California: SAGE.

SEJ (The Scottish Educational Journal) (2015) Focusing on workload, *The educational institute for Scotland*, 99:3, 8-9.

Scottish Government (2009a) Curriculum for Excellence: Building the curriculum 4 - Skills for learning, skills for life, skills for work. Retrieved from https://www2.gov.scot/resource/doc/288517/0088239.pdf

Scottish Government (2009b) Curriculum for Excellence - Health and wellbeing: Principles and practice. Retrieved from https://education.gov.scot/Documents/health-and-wellbeing-pp.pdf

Scottish Government (2010) A Digital Ambition for Scotland [online]. Retrieved from http://www.scotland.gov.uk/Resource/Doc/127299/0114686.pdf

Scottish Government (2011) Scotland's Digital Future: A Strategy for Scotland. Retrieved from http://www.scotland.gov.uk/Resource/Doc/981/0114237.pdf

Scottish Government (2015a) Literature Review on the Impact of Digital Technology on Learning and Teaching. Retrieved from https://dera.ioe.ac.uk/24843/1/00489224.pdf

Scottish Government (2015b) Teacher Consensus Supplementary Data. Retrieved from http://www.gov.scot/Topics/Statistics/Browse/School-Education/teachcenssuppdata/teachcensus2014.

Scottish Government (2016) Enhancing learning through the use of digital technology - a digital learning and teaching strategy for Scotland. Retrieved from https://www.gov.scot/publications/enhancing-learning-teaching-through-use-digital-technology/

Scottish Government (2018a) Digital and technology services framework (DATS). Retrieved from https://www2.gov.scot/Topics/Government/Procurement/directory/itms/itservicesframework

Scottish Government (2018b) School PE Provision. Retrieved from https://www2.gov.scot/About/Performance/scotPerforms/partnerstories/Outcomes-Framework/Physical-Confidence-Competence/School-PE-Provision

Scottish Qualifications Authority (2012a) Physical Education National 4: Course & unit support notes. Version 1.0. Retrieved from http://www.sqa.org.uk/files_ccc/CfE_CourseUnitSupportNotes_N4_HealthWellbeing_PhysicalEducation.pdf

Scottish Qualifications Authority (2012b) Physical Education National 5: Course & unit support notes. Version 1.0. Retrieved from http://www.sqa.org.uk/files_ccc/CfE_CourseUnitSupportNotes_N5_HealthWellbeing_PhysicalEducation.pdf

Scottish Qualifications Authority (2012c) Higher Physical Education: Course & unit support notes. Version 1.0. Retrieved from http://www.sqa.org.uk/files_ccc/CfE_CourseUnitSupportNotes_Higher_HealthandWellbeing_PhysicalEducation.pdf

Seale, C. (2002) Quality Issues in Qualitative Inquiry Qualitative Social Work, 1, 1, 91-110.

Seith, E. (2017 April 28th) Government spends an 'astounding' £69m on Glow, *Times Educational Supplement (Scotland).* Retrieved from https://www.tes.com/news/tes-magazine/tes-magazine/government-spends-astounding-ps69m-glow

Selwood, I. & Pilkington, R. (2005) Teacher workload: Using ICT to release time to teach, *Educational Review*, 57:2, 163-174.

Semiz, K. and Levent-Ince, M. (2012) Pre-service physical education teachers' technological pedagogical content knowledge, technology integration self-efficacy and instructional technology outcome expectations, *Australasian Journal of Educational Technology*, 28:7, 1248-1265.

Selfe, C. (1990). Technology in the english classroom: Computers through the lens of feminist pedagogy. In C. Handa. *Computers & community: Teaching composition in the twenty-first century* (Ed. pp. 118–139). Portsmouth, NH: Boynton/Cook.

Selwyn, N. (2011) *Schools and schooling in the digital age-A critical analysis*, Abingdon, England: Routledge.

Selwyn, N. (2014) *Distrusting educational technology - critical questions for changing times*, New York: Routledge.

Selwyn, N. (2016) *Is technology good for education*?, Cambridge, England: Polity Press.

Selwyn, N. (2017) *Education & technology* (2nd ed.), London: Bloomsbury Academic.

Selwyn, N., Nemorin, S., Bulfin, S. & Johnson, N.F. (2018) *Everyday schooling in the digital age - high school, high tech?*, Abingdon, England: Routledge.

Shenton, A.K. (2004) Strategies for ensuring trustworthiness in qualitative research projects, *Education for Information,* 22, 63–75.

Shewmake, J.C., Merrie, M.D. & Calleja, P. (2015) X-box Kinect gaming systems as a supplemental tool within a physical education setting: third and fourth grade students' perspectives, *The Physical Educator*, 72, 142-152.

Sircar, S. & Choi, J. (2009) A study of the impact of information technology on firm performance: a flexible production function approach, *Information Systems Journal*, 19:3, 313-39.

Silverman, D. (2005) *Doing qualitative research-a practical handbook,* London: SAGE.

Silverman, D. (2006) *Interpreting Qualitative Data* (3rd ed.) London: SAGE.

Sinelnikov, O.A. (2012) Using the iPad in a sport education season, *Journal of Physical Education, Recreation and Dance*, 83:1, 39-44.

Sinkovics, R. R & Alfoldi, E. A. (2012) Progressive focusing and trustworthiness in qualitative research the enabling role of computer-assisted qualitative data analysis software (CAQDAS), *Management International Review,* 52, 817-845.

Stern, P. N. (2007) On solid ground: Essential properties for growing grounded theory. In Bryant, A. & Charmaz, K. *The SAGE handbook of grounded theory* (Eds. pp. 114-126), London: SAGE.

Stidder, G (2011) Using information and communication technology to support learning and teaching in physical education. In Stidder, G. & Hayes, S. *The really useful physical education book-learning and teaching across the 7-14 age range* (Eds. pp. 176-186), Abingdon, England: Routledge

Stidder, G. & Capel, S. (2010) Using information and communication technology to support learning and teaching PE. In Capel, S. & Whitehead, M. *Learning to Teach Physical Education in the Secondary School: A companion to school experience* (3rd ed.) (Eds. pp.183-196) Abingdon, England: Routledge.

Strübing, J. (2007) Research as pragmatic problem-solving: The pragmatist roots of empirically grounded theorizing. In A. Bryant & K. Charmaz *The SAGE handbook of grounded theory* (Eds. pp. 580-602), London: SAGE.

Tannehill, D., van der Mars, H. & MacPhail, A. (2013) Supporting technology for teaching physical education. In Tannehill, D., van der Mars, H. & MacPhail, A. *Building effective physical education programs* (pp. 341-360), Burlington, MA: Jones & Bartlett Learning.

Taylor, S. (2009) Information and communication technology in physical. In Grout, H. & Long, G. (2009) *Improving teaching and learning in physical education* (Eds. pp. 146-176), Maidenhead, England: Oxford University Press.

Tearle, P. & Golder, G. (2008) The use of ICT in the teaching and learning of physical education in compulsory education: how do we prepare the workforce of the future?, *European Journal of Teacher Education*, 31:1, 55-72.

Tearle, P & Katene, W. (2005) The role, current practice & potential for the use of ICT in physical education in secondary schools: A pilot study. *Paper presented at the British Educational Research Association Annual Conference, University of Glamorgan*, 14-17 September 2005.

Thomas, G. (2013) *How to do your research project*, London: SAGE.

Thomas, A. & Stratton, G. (2006) What we are really doing with ICT in physical education: a national audit of equipment, use, teacher attitudes, support, and training*, British Journal of Educational Technology*, 37:4 617-632.

Tondeur, J., Devos, G., van Houtte, M., van Braak, J., & Valcke, M. (2009) Understanding structural and cultural school characteristics in relation to educational change: The case of ICT integration, *Educational Studies,* 35, 223-235.

Tour, E. (2017) Teachers' self-initiated professional learning through Personal Learning Networks*, Journal Technology, Pedagogy and Education,* 26:2, 179-192.

Hauge, T.E., Norenes, S.O. & Vedøy, G. (2014) School leadership and educational change: Tools and practices in shared school leadership development, *Journal of Educational Change*, 15:4, 357-376.

Trout, J. (2013) Digital movement analysis in physical education, *Journal of Physical Education, Recreation & Dance*, 84:7, 47-50.

Uluyol, C. & Sahin, S. (2016) Elementary school teachers' ICT use in the classroom and their motivators for using ICT, *British Journal of Educational Technology,* 47:1, 65–75.

The University of Edinburgh (2011) *Research Data Management Policy*. Retrieved from https://www.ed.ac.uk/information-services/about/policies-and-regulations/research-data-policy

Von Hippel, E. (2005) *Democratizing Innovation,* Cambridge, England: The MIT Press.

Warren, C.B. (2001) Qualitative interviewing. In Gubrium, J.F. & Holsteing, J.A. *Handbook of interview research-context & method* (Eds. pp. 83-102), Thousand Oaks, California: SAGE.

Weir, T. & Connor, S. (2009) The use of digital video in physical education, *Technology, Pedagogy & Education*, 18:2, 155-171.

Weiss, C. H. (1998) *Evaluation* (2nd ed.), New Jersey: Prentice-Hall

Wilson, A. & McKinney, S. (2012) Glow or glimmer? A case study of ICT innovation in a Scottish secondary school, *Scottish Educational Review,* 44:1, 57-69.

Williams, B. (2002) *Truth & truthfulness*, USA: Princeton University Press.

Wiske, S. (2004) A new culture of teaching for the 21st century to maximize the benefits of technological innovation, we need to change the way we think about teaching in K-12 schools. In Gordon, D.T. *The digital classroom: How technology is changing the way we teach & learn* (Ed. pp. 69-77), USA: Harvard Educational Review.

Whittemore, R., Chase, S.K. & Mandle, C.L. (2001) Validity in qualitative research, *Qualitative Health Research*, 11, 522-537.

Willig, C. (2008) *Introducing qualitative research in psychology* (2nd ed.), Berkshire, England: Open University Press.

Willig, C. (2013) *Introducing qualitative research in psychology* (3rd ed.), Berkshire, England: Open University Press.

Wolcott, L. L. & Betts, K. (1999), What's in it for me? Incentives for faculty participation in distance education, *Journal of Distance Education*, 14:2, 34-49.

Yeung, A.S., Tay, E., Hui, C., Lin, J.H., & Low, E. (2014). Pre-service teachers' motivation in using digital technology, *Australian Journal of Teacher Education,* 39:3, 135-153.

Zambo, R. & Zambo, D. (2013) Using I poems to hear the voices and understand the actions of EdD students conducting action research, *The Qualitative Report*, *18:42*, 1-17.

Appendix A: Consent form and study information

The University of Edinburgh

Moray House School of Education
St Leonard's Land (Rm G6)
Holyrood Road
Edinburgh
EH8 9JX
0131 651 6043
murray.craig@ed.ac.uk
January 2016

Dear,

My name is Murray Craig and I am a Doctor of Education (EdD) student at the University of Edinburgh. My EdD thesis is focussed on the experiences and values of Scottish secondary school physical education teachers, specifically in relation to technology use within the teaching and learning of their subject. I aim to develop a greater awareness and appreciation of teacher's involvements with technology, and acquire information that may be used to inform teachers' future practices in this particular field within Scotland and beyond.

I am hoping to arrange and conduct interviews with teachers between February and May 2016. This will involve two separate individual interviews with each teacher, each lasting no longer than one hour. All interviews will be voice-recorded. The data collected will only be used for this particular EdD thesis, and for subsequent conference presentations and academic publications. When findings from the study are reported, a pseudonym will be used to ensure the anonymity of all teachers and schools involved. Please note, I will be the only person to know the pseudonyms used and the identities of each teacher and their respective school.

If you have read the background information detailing the nature and purpose of the study, as well as the data collection method to be used, I would be most grateful if you would agree to participate in the study by signing and returning the participant consent form. Participation is voluntary, and you are entitled to be treated fairly and sensitively, with the right to withdraw from the study at any time without consequence.

If you have any questions or require further information about the planned research, you can contact me directly at work on 0131 651 6043 or at murray.craig@ed.ac.uk

Alternatively, you can contact my supervisors at:
Dr. Christine Nash: cnash@ed.ac.uk
Dr. Jen Ross: jen.ross@ed.ac.uk

Yours sincerely

Murray Craig

Appendix A (ctd): Consent form and study information

THE UNIVERSITY *of* EDINBURGH

Background Information

Aim

The purpose of the study is twofold:

1. To identify and develop an understanding of the key features of secondary school physical education teachers' experiences involving technology within the teaching and learning of their subject.

2. To develop an appreciation of secondary school physical education teachers' values concerning technology use within the teaching and learning of their subject.

Participants

The study will focus on a group of eight secondary school physical education teachers in Scotland who are already making use of technology in their teaching practice. The intention is to inform and advance our understanding of the use of technology in the learning and teaching of secondary school physical education in Scotland.

What will the study involve?

Two 1 to 1 interviews, each lasting no longer than one hour, will be carried out with each teacher to explore their experiences and values in relation to technology use in physical education. The interviews are planned to be conducted between February and May 2016. Each interview will be voice-recorded, with all information remaining confidential (information concerning confidentiality and anonymity is included in the informed consent letter attached). There will be flexibility as regards the date, time, and location of the interviews to be carried out. However, it is hoped that at least one of the two interviews can take place at each teacher's school. Participants will not incur any expense as a result of taking part in the research.

Appendix A (ctd): Consent form and study information

Ethical Information

The information collected as part of this study will be treated in strictest confidence. All voice recordings and subsequent transcriptions, as well as field notes will be stored on a password protected computer, and any hard copies of the data produced stored in a secure facility at the University of Edinburgh. The data collected from participation in the study will only be used for this particular EdD thesis, as well as subsequent conference presentations, and academic publications. Upon request all participants will be able to receive any documents and publications produced. When the results of the study are reported, a pseudonym will be used to ensure anonymity of all teachers involved and the schools at which they work.

Participant Consent Form

I confirm that I have received relevant background information from Murray Craig as regards my participation in his research study. This research is being conducted for a Doctor of Education (EdD) degree at the University of Edinburgh, under the supervision of Dr Christine Nash and Dr Jen Ross. I understand that giving my consent to participate in this study will involve participating in two separate recorded one to one interviews to discuss issues relating to my experiences and values as regards the use of technology within the subject area of physical education.

- I understand my participation in this research is voluntary.
- I have been made aware that I am entitled to be treated fairly and sensitively, and that I have the right to withdraw from the study at any time without consequence.
- I have been assured that any information collected as part of this study will be treated in the strictest confidence.
- I am aware that my identity and school will remain anonymous, and I have been informed of the conditions under which this information will be stored.
- I understand that all data collected will only be used for this EdD thesis, for academic publications and for conference presentations.
- It has been made clear that I can contact Murray Craig if I would like to receive any documents and publications that arise out of my participation in the study.

Appendix A (ctd): Consent form and study information

If I have any queries about the research, I know that I can contact Murray Craig on 0131 651 6043 or at murray.craig@ed.ac.uk. Alternatively, I know I can contact Murray Craig's supervisors: Dr Christine Nash: cnash@ed.ac.uk; Dr Jen Ross at jen.ross@ed.ac.uk

My signature below confirms my consent to participate in the study.

Name (please print):

_____

Signed:

_____

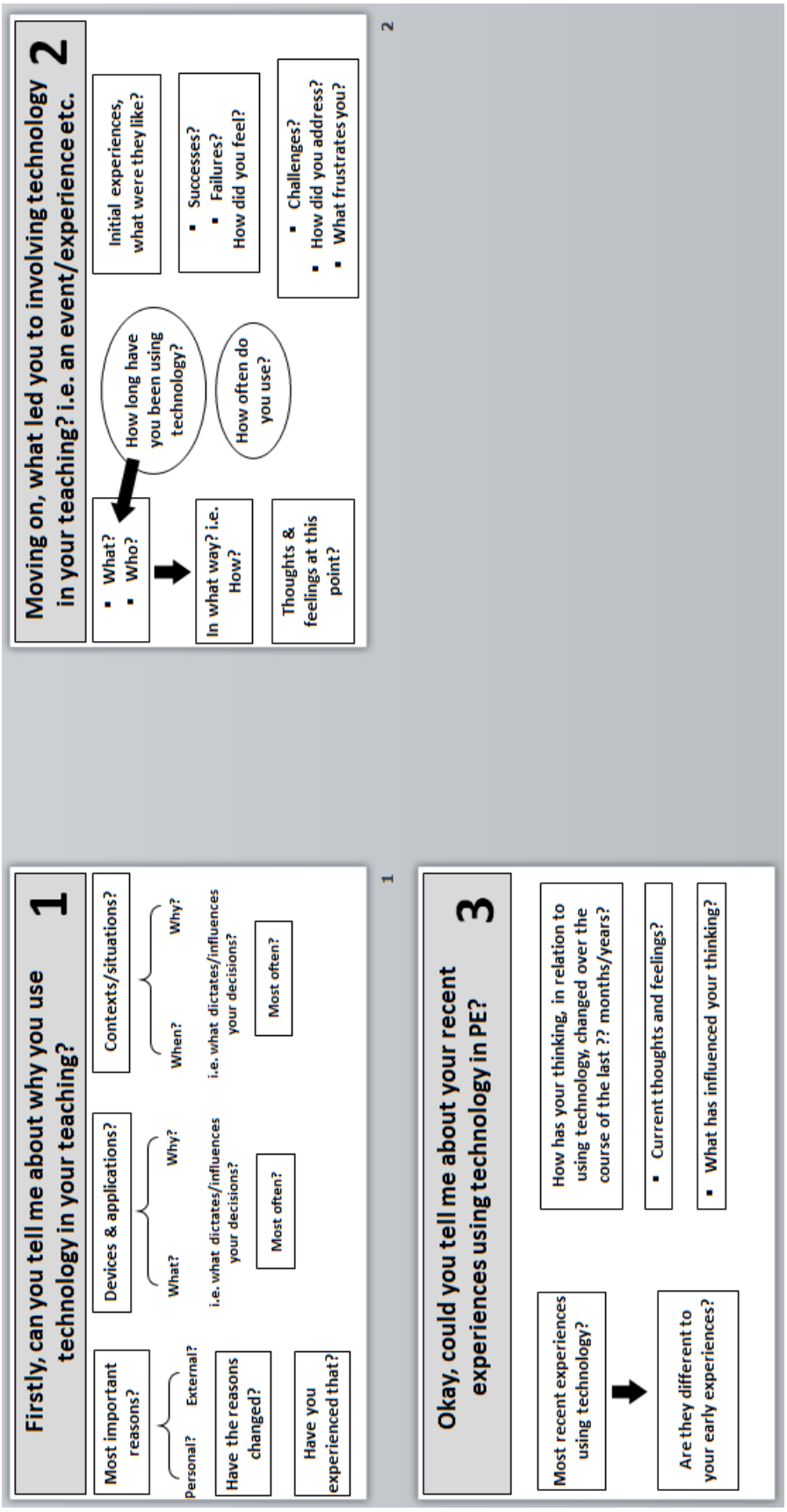
Date:

_____

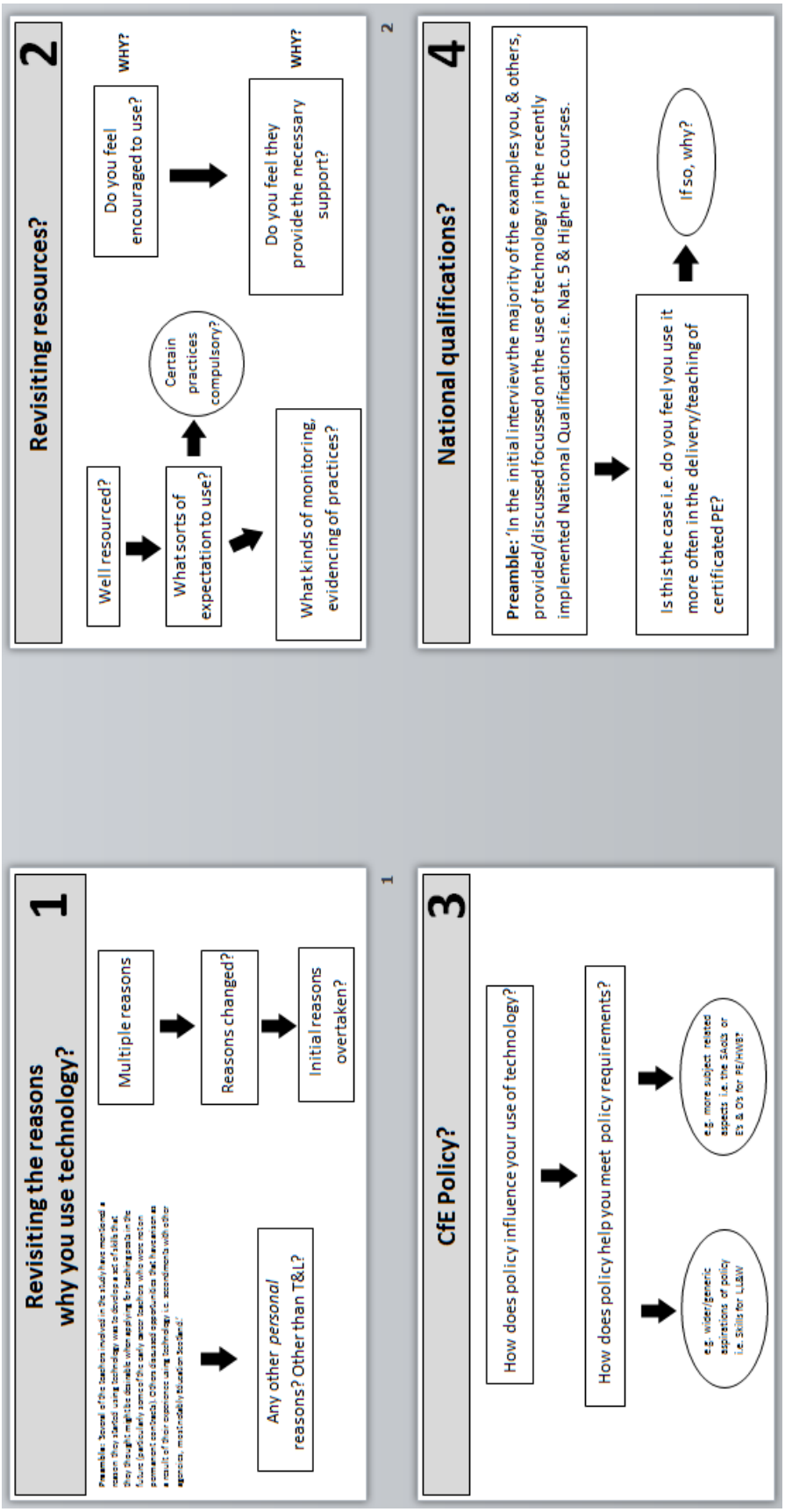
Appendix B: Participant background information form

Participant Background Information			
Personal			
Name:	*Age:*	*Gender:* **M / F**	
Teaching			
Initial teacher education - institution attended:	*Teaching qualification/degree gained: e.g. BEd, PGDE or other*	*Other qualifications gained:*	
Teaching experience (years):	*No. of schools in which you have been employed:*		
Current school:	*Current position held: e.g. probationer, main grade teacher, principal teacher etc.*	*Duration of service at your current school (years):*	
Other positions/roles currently or previously held e.g. secondments or position with associated bodies i.e. Education Scotland, SQA, SATPE, involvement in local authority or national working groups etc.			

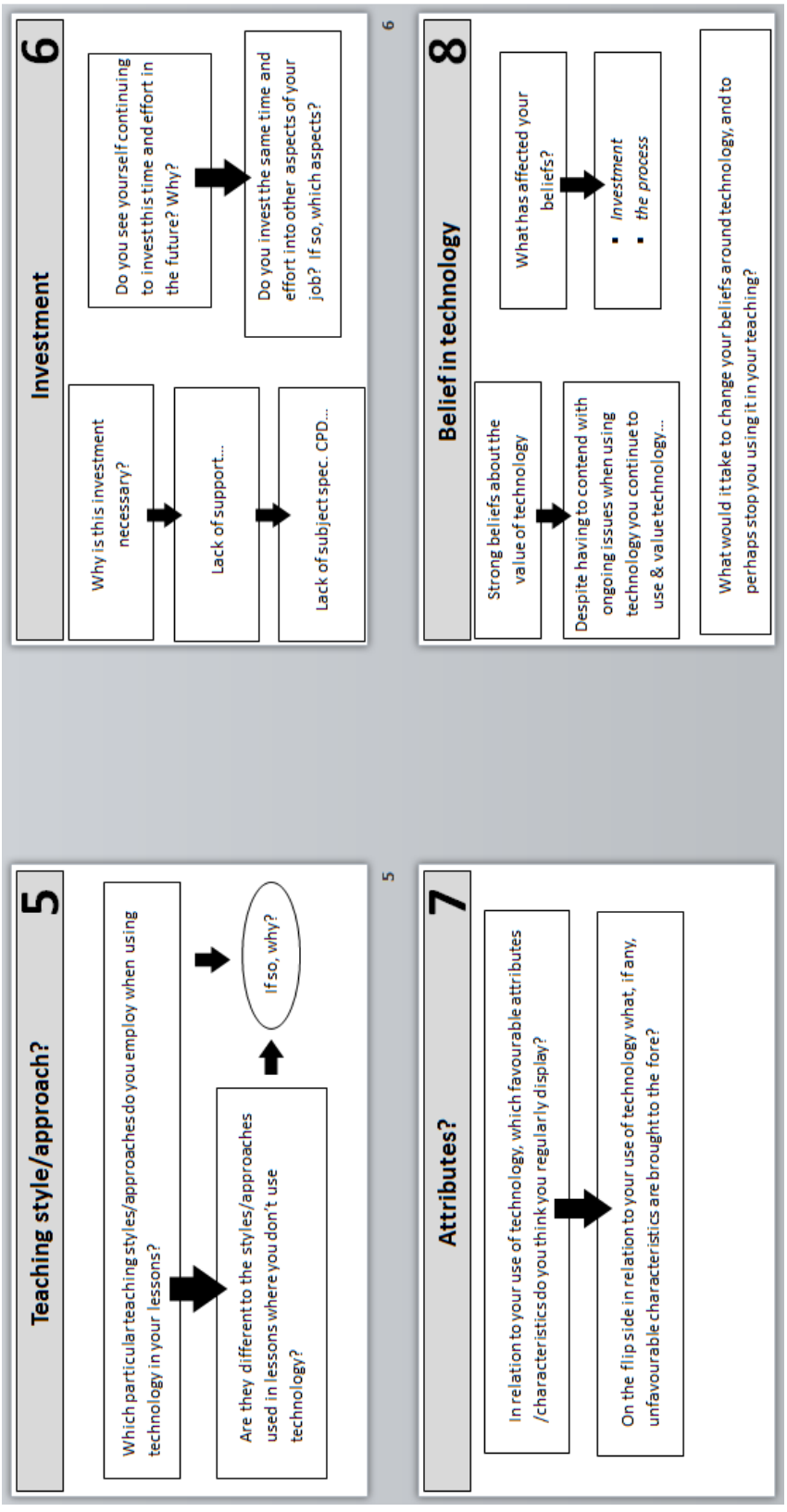
Appendix C: Interview guide - initial interview



Appendix D: Interview guide - follow up



Appendix D (ctd): Interview guide - follow up



Appendix E: Field journal (blank)

Field Journal/Diary			Entry:
Day:	Date:	Time:	
Interview:	Participant:	School:	
Day:	Date:	Time:	Duration:
Observations (Environment):			
Observations (Participant):			
Personal Reflections:			
Sensitizing Concepts:			
Recurring Themes:			
Key Words/Terms/Phrases:			
Signed:	Date:	Time:	